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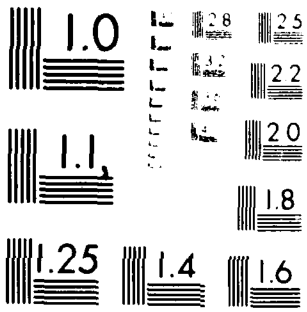
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TECHNICAL REPORT RH-82-4

# WAVE OPTICS INVESTIGATIONS OF TRANSVERSE MODE FORMATION

R. W. Jones
Directed Energy Directorate
US Army Missile Laboratory

and

J. F. Perkins and C. C. Shih
University of Alabama
Huntsville, AL 35801



March 1982

U.S. ARMY MISSILE COMMAND
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| | | |
|---|---|---|
| 1. REPORT NUMBER<br>RH-82-4 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle)<br>WAVE OPTICS INVESTIGATIONS OF TRANSVERSE MODE FORMATION | | 5. TYPE OF REPORT & PERIOD COVERED<br>6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s)<br>J. F. Perkins C. C. Shih<br>R. W. Jones | | 8. CONTRACT OR GRANT NUMBER(s) |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>Commander<br>US Army Missile Command<br>ATTN: DRSMI-RH/Redstone Arsenal, AL 35898 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS<br>Commander<br>US Army Missile Command<br>ATTN: DRSMI-RPT/Redstone Arsenal, AL | | 12. REPORT DATE<br>March 1982<br>13. NUMBER OF PAGES<br>284 |
| 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) | | 15. SECURITY CLASS. (of this report)<br>UNCLASSIFIED<br>15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Transverse resonator
Fresnel oscillatory

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Since the earliest days of laser operation, attention has been given to the properties of transverse modes of the radiation field within the laser, for both stable and unstabel resonator configurations. One of the principal purposes of seeking good transverse mode properties is to obtain a well defined far field distribution with a large value of central intensity.

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I. INTRODUCTION

Since the earliest days of laser operation, attention has been given to the properties of transverse modes of the radiation field within the laser, for both stable and unstable resonator configurations. One of the principal purposes of seeking good transverse mode properties is to obtain a well defined far field distribution with a large value of central intensity. In this connection there have been many theoretical and computational studies of transverse modes of unstable resonators operating in CW (continuous wave) or quasi -CW manner. Such studies can assist in design of a particular resonator configuration. In addition, such studies have revealed certain general properties which lead to useful practical rules for resonator design. These include a recommendation that the designer should tend to choose a relatively large value of resonator magnification. In addition, the design should have an equivalent Fresnel number well removed from an integer plus 7/8, well removed form 9.875.

For pulsed operation of an unstable laser resonator, the properties and design guidelines for CW lasers presumably also apply. In addition, one must consider properties that are unique to the pulsed feature. In particular, the transverse mode properties have temporal dependence which must be considered. It is desired that a good quality (as measured by far field central intensity, for instance) transverse mode shall be formed within a period of time after pulse initiation which is less than the time required for the radiation flux to grow to its final saturated value. This is so that the preponderance of the emitted energy will be propagated to a well defined target area.

If the time required for the resonator mode to develop is comparable to the time required for the circulating power in the resonator to reach a level approaching its maximum value, substantial energy may be extracted from the resonator during a time period when that energy is not well directed to the target. In that event, a substantial fraction of potentially deliverable energy will be wasted.

The allowable amount of time and number of resonator round trips for formation of a good transverse mode is a function of the gain of the laser; of the ration between saturation intensity and the intensity of the "noise" signal from which the amplification process begins. In general the level of spontaneous emission noise tends to be large in excimer lasers or other lasers with relatively short wavelengths. Thus the problem of transverse mode formation is potentially much more troublesome for short pulsed excimer lasers than for lasers operating in the infrared. The potential problem of mode formation was recognized early in the development of high energy excimer lasers.

The basic assumption underlying this work is that mode formation properties can be studied computationally by a modelling process which is intended to directly imitate the physical process, namely introduction of a weak wave with randomized phase into the cavity, followed by successive round trip propagation of the radiation. The beam quality after each round trip can be determined in various ways, of which the best is simply the calculation of the overall far field intensity distribution. After a certain number of round trips, in a particular calculation, the far field peak intensity will have reached an acceptable fraction (about 90%) of its idealized value (i.e. of the value that would result for a wave with the same total flux but with uniform intensity and phase at the output aperture) and have its highest intensity peak falling within an acceptably small angle (half a diffraction angle) of its final "straight ahead" direction. A number of such calculations were performed. It was found that in general the computational results seemed in satisfactory qualitative agreement with a simple formula which predicts the average number of round trips which are required for mode formation. A more striking finding was that the required number of round trips and the approach of the far field properties to their final idealized values varies quite substantially from case to case. There is considerable statistical variation in the mode formation process. Thus, an adequate modelling of the mode formation process requires a statistical approach. The purpose of the present study is to carry out such a statistical study of mode formation.

For high energy lasers, the tube Fresnel number (square of beam halfwidth divided by wavelength and by mirror spacing) can vary over a large range (1 to 10,000). Thus a realistic wave optics calculation, even in the two dimensional approximation, can require a very large number of mesh points for large Fresnel numbers. It is difficult to be precise, but the number of mesh points needs to be of the order of the tube Fresnel number; hence, as large as 10,000. Thus, the calculation of mode formation in excimer lasers can require large amounts of computer storage and time. Consequently, in the present study the approach used was that of determining the scaling of mode formation properties as a function of tube Fresnel number and magnification. Calculations were performed at a variety of values of magnification and Fresnel number. During the course of the work it was found that we could obtain a larger number of modelling calculations and at least a few calculations for larger values of Fresnel number than originally anticipated.

In order to carry out a substantial number of mode formation calculations as required for a statistical study, it was very desirable to arrange the computer program to function as efficiently as possible; especially to produce results as close as possible to the final desired form to avoid the necessity of hand plotting voluminous resluts. It was also desirable to extend the code to enable calculation of cases with Fresnel numbers larger than those that could be treated with the previously abailable code. The extensions of the wave optics code are discussed in the following sections.

Concurrent experimental investigations of mode formation were carried out at MICOM. The present computation study, including a number of calculations intended to model specific candidate configurations for experiments, was coordinated with this experimental work, and are discussed in the following section.

## II. EXTENSION OF TWO DIMENSIONAL WAVE OPTICS CODE

The two dimensional wave optics resonator code, designated as CAVT7, was quite adequate for a number of purposes. However, it needed extension for use in mode formation modelling studies for resonators of large Fresnel numbers associated with large excimer lasers. This section brefly discusses the properties of the CAVT7 code and of the extended code, designated CAV2D, as they relate to those investigations.

As background information, it may be of interest to consider why a two dimensional wave optics code is of use. One might suppose that a three dimensional code would usually be required to deal with problem of laser resonators. This would be unfortunate, if true, because of the large amounts of computer storage and computational time that are required for three dimensional calculations. For a wide class of problems, the complex optical amplitude, which for a particularly axial location is a function of the two transverse variables X and Y and can be expressed rigorously or to a satisfactory degree of approximation as a product of a function of X and a function of Y. This reduces the overall three dimensional problem to two independent two dimensional problems. This factorability depends on having a rectangular symmetry to the overall problem (problems with circular symmetry can also be reduced to one dimensional problems). Factorability also requires that the gain as a function of transverse position can be expressed as a product of functions of X and Y. This condition is often satisfied for cases of weakly saturated gain, and in particular for problems of "empty resonator: type. In summary, there is a large class of resonator problems for which two dimensional calculations are quite adequate. The output radiation from an unstable resonator is not factorable in this manner, because of the obscuration resulting from the feedback mirror. Even for the problem of progagation of the output radiation the problem is considerably simpler than a fully general therr dimensional situation. The output can be expressed as the difference of two functions, each of which is separately factorable.

Because two dimensional wave optics calculations are of broad applicability, while three dimensional calculations require more storage and computer time. We have until recently restircted our work to two dimensional calculations but have prepared and used a three dimensional code, for other applications. Restriction to two dimensional problems result in storage requirements which are modest for most applications because for most lasers the Fresnel number is not very large, perhaps a few hundred. The required number of mesh points is only perhaps 2048. This modest mesh point requirement made it quite feasible to employ several arrays in the CAV2D program to describe simultaneously (for each round trip) the amplitude at each of several places.

High energy lasers (e.g., excimer lasers) exist which may have much larger values of Fresnel number, with tube Fresnel number as large as 10,000, than the class of lasers previously treated. In order to be able to carry out reliable and realistic calculations, including adequate resolution of detail etc., it became desirable to use much larger numbers of mesh points than needed previously. We accordingly modifed the wave optics code to reduce the number of separate arrays of complex optical amplitude to the minimum possible number (two). This involved relatively little sacrifice of generality of results. It does become necessary to make any desired prints or printer plots of an array at a certain stage of execution, since the array will be overwritten at a later stage of execution.

In CAVT7 the required discrete Fourier transforms had been carried out with an FFT subroutine which was available only in machine language; the Fortran source code was not available. A separate FFT subroutine, which is available in Fortran source code, was introduced instead into the CAV2D program in order to facilitate use of larger amounts of computer memory in certain cases.

Features were also added for the specific purpose of mode formation studies. Their explanation requires comments on the earlier mode formation calculations. Calculations are carried out with randomized phase for the starting wave, in order to model the effect of the mode buildup from noise. One is interested in the output optical quality as it affects the far field intensity distribution. Thus one calculates, after each iteration (i.e. each round trip of radiation through the resonator) the far field intensity distribution. For studying mode formation the option had earlier been provided of calculating and making a printer plot of the far field distribution after each round trip. One can then examine the succession of printer plots that are produced by each calculation. This had revealed certain general features, the fact that after a few round trips there usually developed a pattern which is similar to the final Fraunhofer pattern, but which (a) has a maximum intensity less than the final value, (b) has its highest peak in a direction different from the final "straight ahead" direction, and (c) displays behavior which is quantitatively different from case to case. The properties (a) and (b) can best be displayed by a plot of the relative intensity, and the angular position of the highest peak, as a function of round trip number and were originally made by hand. In order to avoid the tremendous amount of hand plotting associated with a large number of independent calculations, the code was extended to optionally prepare such plots using the line printer. One could print the far field distribution after each round trip if desired, but this would result in an undesirably large amount of output printing. A rather large number, well over 100, of separate cases were to be treated and it seemed important to permit optional suppression of the print of far field distribution after each round trip.

No effort has been made here to describe in detail the steps which are involved in going from CAVT7 to CAV2D or the detailed features of the codes. These can be understood by reference to the code listings themselves. The consequences of the code extension can be noted by observing the enclosed samples of results. A considerable number of calculations have been performed.

Some for larger Fresnel numbers than have previously been attempted. Methods that would permit modelling of large Fresnel numbers as treated here, presumably the only calculations for Fresnel numbers this large are those done with the Horwitz asymptotic expansion method.

## III. MODELLING STUDIES RELATED TO CO2 EXPERIMENTS

Experimental investigations of transverse mode formation were planned and conducted at MICOM during the same general time period as that in which the extended computational modelling studies were being carried out. The computational modelling was coordinated with the experimental studies. The initial phase of experimental studies were carried out at MICOM with CO2 lasers; it is this phase of experimental work that will be discussed in the following paragraphs

The nominal number of round trips for formation of a satisfactory transverse mode scales as the logarithm of the tub Fresnel number (Ft) and inversely as the logarithm of the magnification (M) of the (positive branch confocal) resonator:

$$NRT = \ln(Ft)/\ln(M).$$

For a typical E-beam initiated, electric discharge pumped CO2 laser (EBL), the tube Fresnel number is of the order of 100. If one considers a typical magnification of the order of 2.0, one obtains a predicted number of round trips of about 7. To convert to a typical mode formation time we assume a mirror separation of L=300 centimeters, for which the round trip time is given by 2L/c=20 nsec. The predicted round trip time is then about 7 times this value, or about 140 nsec. Such a time is substantially shorter than the typical overall pulse width of a CO2 EBL. Thus one would prefer to employ a resonator with a substantially smaller value of magnification for such studies, provided the properties of such a low magnification resonator are otherwise satisfactory. Attention was given to this problem during these modelling studies.

It must be recognized that there is some practical limit to how small, more precisely how near unity, the magnification of an unstable resonator can be made. As M approaches unity, the resonator approaches stable type with plane mirrors, a type that has long been recognized as undesirable when approached from the stable resonator side. For magnifications only slightly in excess of unity, one would expect that the discrimination between various transverse modes would be very poor. This is manifested in the general type of calculations being conducted in this study, calculations which iteratively treat propagation back and forth between mirrors until self consistency within a multiplicative factor is achieved, by very slow convergence, or even a failure ever to achieve convergence within a practicable amount of calculation. Slow convergence of calculations can also occur when the equivalent Fresnel number of the resonator is near an integer plus 7/8, e.g. 6.875. The modulus of the ratio of optical amplitudes at a selected point on successive round trips is used as an indicator of convergence. This value often displays an oscillatory behavior when convergence is very slow.

A variety of values of magnification was treated in the overall trend studies of mode formation, including values of 1.414 and 1.32. For these values, the general behavior of the calculations seemed satisfactory. In efforts to achieve a relatively long mode formation time for the CO2 EBL experimental studies, exploratory calculations were also carried out for smaller values of M, including 1.14, 1.184, and 1.195. For these smaller values of M it was found that the calculations displayed troublesome behavior, with very slow convergence properties. Also for some of these calculations the number of round trips required for formation of a satisfactory for field beam were even greater than the nominal value predicted by the formula given above. No significance has been attached to the latter fact, in view of the peculiar overall behavior of the calculations. The general conclusion which seems to follow is simply that modelling calculations strongly suggest that one should not operate an unstable resonator with a magnification as small as 1.2.

For the various calculations with M=1.32, the behavior seemed quite reasonable. These calculations include not only the M=1.32 cases of the general trend studies, but also set of calculations with tube Fresnel number of 81.61 (for possible future reference we mention that these have been assigned run numbers 483-486) for which the far field was plotted on each iteration. We therefore tentatively recommended an experimental arrangement with a magnification of 1.32, and that value has been used. We cannot say that a slightly smaller value of magnification would not also be satisfactory, there is no threshold behavior, as far as we know. Note that use of a magnification of 1.32 gives a predicted mode formation time which is about 2.5 times as long as for a magnification of 2.0. Thus it seemed possible to push the expected mode formation time for CO2 EBL experiments to the general range of 350 nsec.

## IV. MODE FORMATION CALCULATIONS FOR SCALING STUDIES

As noted, the earlier modelling studies had shown an appreciable degree of case to case variation in transverse mode formation, and a statistical study was needed. The present study was planned to include an investigation of the statistical properties of the dynamics of transverse mode buildup by performance of wave optics calculations which determine the transverse distribution of intensity and phase in the resonator and the resulting far field intensity distribution on successive round trips following the initiation by a wave with randomized phase distribution.

The average number of round trips required for formation of an output beam of satisfactory output quality, and the statistical spread of this number, was to be determined for each of several sets of resonator parameters. The numerical quantity of modelling calculations was not specified, but was expected to depend on computer time and memory requirements and availability. These requirements are quite substantial for the larger values of Fresnel number, which are of greatest interest for excimer applications. Nevertheless it has turned out that quite a large number (over 200) of separate mode formation modelling calculations have been performed.

A relatively modest number (less than 200) of mode formation modelling calculations would presumably be adequate to determine the statistical properties for a particular combination of tube Fresnel number and magnification. Unfortunately, the Fresnel numbers of greatest importance for the excimer applications are quite large (of the order of 10,000). Reliable calculations for such cases require a very large number of transverse mesh points (number of mesh points comparable to or somewhat larger than the Fresnel number). At the outset of this work it appeared that such calculations would be entirely unfeasible. It has turned out that we can barely reach the values of Fresnel number which excimer lasers are likely to have, but the computer time requirements are quite large. The investigation of mode formation properties has therefore proceeded largely in terms of a scaling study, as was originally planned.

Calculations have been carried out up to reasonably large Fresnel numbers, as planned. In order to extend the results to the excimer range, as well as to gain knowledge of the scaling trends for general purposes, we have carried out mode formation calculations for a number of combinations of Fresnel number and magnification. In this way one can determine the scaling trends, and use them as a means to predict the average and statistical spread of the number of round trip times required for satisfactory mode formation for typical excimer lasers.

The combination of (a) a requirement to perform several individual (statistically independent) calculations for each set of resonator parameters, led us to carry out a rather large number of individual calculations. Some discussion of the individual calculations will be given in this section. To investigate statistical properties and scaling trends it became virtually necessary, because of the large volume of results, to prepare auxiliary computer programs.

Individual mode formation modelling calculations have been assigned run numbers, which will serve as a convenient method for referring to particular runs and the associated plots of results. The plots which are prepared in a form suitable for inclusion in this report by an auxiliary computer program MFLPQ are included. The run numbers are listed on the plots, and take the place of Figure numbers.

A large fraction of the calculations have involved resonator magnifications of approximately 1.32, 1.414, 1.587, 2.0, 2.8284, and 4.0. The expected number of round trips required for mode formation is strongly dependent on magnification, being only one-fourth as large for a magnification of 4.0 as for 1.414. Consequently the results for smaller values of magnification can show a greater richness of detail in fluctuations of intensity and angular position prior to setting down.

The calculations have largely employed tube (outer) Fresnel numbers which ranged in multiples of 2.0 from 76.8 to 1228.8, with a few cases going to 2457.6 and 4915.2.

Because of the inherent nature of plots generated by computer plotters, the plots of individual runs are rotated 90 degrees on the page as compared to conventional plots. To orient each plot in the manner associated with conventional (e.g. hand drawn) graphs, each page would need to be rotated so that the label "IP/IO" is on the left hand vertical border, and the label "THETA" is on the right hand vertical border. The values of IP/IO, i.e. of the ratio of the peak intensity on a particular round trip to the ideal (uniphase) value, are plotted using the character "X". The variable THETA is the angle, measured in units of the diffraction angle (ratio of wavelength to near field output beam width), between the nominal, straight ahead direction and the direction at which the highest intensity is found after each resonator round trip. The values of THETA are plotted using the character "+". The number of the round trip is indicated, 1, 2, 3, etc. The scale size used in connection with the round trip number is different among various plots, only integer values are meaningful.

In the plots, IP/IO ranges from 0 to 1.0. It can be noted that the value of this parameter is often quite small, perhaps 0.1 or less, for the first one or more round trips. In the plots, THETA varies from -5.0 to +5.0 diffraction angles. It can also be noted that the value of THETA for the first one or more round trips is sometimes several diffraction angles in magnitude. We emphasize, for definiteness, that the independent variable in the plots is the actual round trip numbers. In later summary and statistical plots the independent variable is instead a normalized parameter.

For each mode formation modelling calculation, the principal properties of interest are: (1) the number of round trips, particularly as compared to the predictions of the nominal formula, required to produce an IP/IO value which has reached, and maintains on later round trips, a large fraction, and (2) the number of round trips, particularly as compared to the predictions of the nominal formula, required to produce a THETA value which has reached, and maintains on later round trips, a magnitude which is rather small (less than half a diffraction angle). For the entire set of such calculations, and/or for various subsets, the statistical variability of both the intensity and angular properties is of major interest.

In general, the mode formation seems reasonably complete within a number of round trips given by the nominal formula, the ratio of logarithms of tube Fresnel number and magnification. But it is clear from examination of the plots that there is a significant statistical spread in the results. To facilitate examination and analysis of the statistical properties, a separate computer program MFRSCHPLOT was prepared and used.

## V. COMPUTATIONAL FACILITIES FOR ANALYSES OF MODE FORMATION RESULTS

The general intent in the mode formation portion of this work has been to model the build up of transverse modes in unstable resonators which are reasonably typical of those to be employed in the DARPA excimer program as a means of investigating the significant effects which will arise experimentally. The general approach is described elsewhere; essentially one models the starting wave with a wave of uniform intensity but randomized phase.

The statistical properties of mode build up were investigated by performing a number of independent modelling calculations, and performing statistical analyses of the combined results. It was realized at the beginning of this work that the amount and statistical significance of the overall results would be dependent on the volume of calculations which could be performed within the limits of manpower, computer availability, memory, and speed. It was not at all clear at the outset how large a volume of calculations could be performed during this study. It has in fact turned out that quite a large volume of calculations have been performed, some 200 moderate to very large calculations have been performed. The overall course of the work has been affected in various ways by features of the various computers and ancillary equipment which have been used. Some of these features and their significance will be described in the following paragraphs.

For visualization of computed results it is desirable to have some form of plotting capability in conjunction with computations. In the present case, this seems to be a fairly general situation, while it is possible to prepare "smooth" line plots, i.e. moderately high resolution plots, of computed results as the computations proceed, it is time consuming and expensive to do so. Such plots require use of separate facilities which must be user operated (i.e. operated by the investigator or his direct associates rather than by computer operator personnel) separately from and independent of the numerical computations themselves. It would seem desirable to have available something like a Tektronix plot capability which can simply be ordered up by the submitted run deck itself.

In the absence of automatically obtainable line plots, one can prepare so called "printer plots" by suitable programming. The plots are necessarily discrete rather than smooth in appearance, but are satisfactory in many respects. To minimize the degree of "coarseness" of the plots one tends to use a large portion of the maximum number of positions (ofter 132) which are available across the printer paper, which is considerably wider than ordinary writing paper or typewriter paper. We have for simplicity often used 100 positions for the plotted points themselves plus several more columns for lables, tic marks, etc. At the beginning of our work on mode formation the CAVT7 computer code had a printer plot provision for the far field intensity distribution. Initially in the mode formation studies we had extracted by inspection of the far field plots the angular position of the highest intensity point in the far field and also the relative intensity at the point for each resonator round trip. The peak intensity and angular position as a function of round trip number were then plotted by hand in a separate procedure.

When it was clearly realized that mode build up is statistical in nature and requires a number of statistically independent calculations for suitable modelling, it became clear that the extraction and plotting of the peak intensity and angular position as a function of round trip number should be automated. This was accomplished in a subroutine MFLPP (mnemonic for "mode formation line printer plot"). The plot occupies somewhat over 100 positions across the printer paper. For convenience it was arranged that one line was usually skipped between each line which is used for plotting results of a particular round trip. Thus some plots occupy more than one printer page. The plots are optional but were almost always called for in the input data

for computer runs in the present work. It is particularly convenient that the plots are entirely automatic and require no further effort or intervention by the investigator, and are physically a part of the overall printed output.

From inspection of each (MFLPP) plot one can make an assignment of the approximate number of round trips which were required in that instance for obtaining a certain level of relative peak intensity (about 90 percent) and also for obtaining and maintaining a desired directionality, within one-half of the diffraction angle from the nominal straight ahead direction. It initially seemed preferable to deliberately have human intervention in assigning values of the "required number of round trips", partly because of uncertainty as to what the criteria for satisfactory mode formation should be as well as of course to simply examine the various plots to take note of any trends that can be spotted, including possibly entirely unexpected ones.

A considerable number of runs were examined and subjected to preliminary analysis in the fashion just described. This initialy approach was limited to consideration of only the number of round trips required before the mode can be said to be satisfactorily formed, with no information obtained about the spread of results prior to its settling down to a satisfactory mode. Also the criteria for judging when the mode is felt to be satisfactorily formed introduces a substantial element of subjectivity into this approach. After a considerable amount of this work had been done, it appeared that a different approach was desirable.

Rather than limiting statistical analyses to the extimated numbers of round trips required for satisfactory completion of the mode formation process, it seemed preferable to include in the analyses the full history of the mode formation process, the angular position of the most intense for field point and its relative intensity for each round trip. For this purpose it became necessary to put into machine readable form the results of the rather large number of mode formation calculations which had been performed. This was done, and involved keypunching, checking, and further manipulation of several thousand data cards. This card images were eventually stored on mass storage and on magnetic tape, to facilitate repeated input to the computer as needed for further analyses.

## VI. COMPUTER PROGRAM MFLPQ FOR MAKING LINE PRINTER PLOTS OF MODE FORMATION RESULTS

It was also realized that a modified computer generated graph of the type produced by the MFLPP subroutine would be desirable in order to present the principal computed results in conveniently readable report form. Two aspects were concerned. First, the routinely generated MFLPP plots are wider than typewriter paper, this porblem could be solved by use of a reducing photocopy operation during or prior to preparation of the technical report presenting the results of this work, although there would be some additional complications due to the fact that some of the plots occupy more than one printout page. Second, the plots were all on the "striped" side of the printer paper, which does not produce a particularly pleasing photocopy. For reasons that are not clear to this author, mainframe computer

installations seem to prefer printing on the "striped" side, and there is some inertia, and additional control card preparation, involved in getting printout on the clear white side of the paper. The upshot of this is that while it is quite feasible to get an occasional run printed on the white side, it would be difficult to get numerous routine runs printed in that fashion. It is quite remarkable that such mundane details became involved even when carrying out rather large scale computations. It became desireable to prepare a separate computer program for preparing printer plots of mode formation results, similar to the MFLPP plots, in a size and format suitable for reporduction in a technical report.

Although a printer plot progarm such as was needed could have been prepared directly for a mainframe computer, it happened to be convenient to prepare the program with a desktop computer and associate printer which ordinarily uses typewriter sized paper. This was particularly convenient because trial plots could be made and examined directly on typewriter sized paper and the program immediately adjusted as needed. It also happened that the Fortran capability of the desktop computer greatly facilitated such testing and program development, sicce one did not have to go to a mainframe installation, or even use the desktop computer as a remote terminal facility operating in terminal demand mode, for such program development. The resulting computer program, named MFLPQ for similarity to MFLPP, includes optional features which are not present, or needed, in MFLPP. For greater clarity of presentation, one or two lines are skipped between the plotted line for each round trip in cases where the total number of round trips is small compared to the maximum number that can be presented on a typewriter sized page.

There were several possibilities with respect to preparation of typewriter paper sized plots of mode formation. Even though the data had been re-entered into punched cards, which cannot be directly read into a desktop computer, the desktop computer could be used to produce plots. This could be accomplished by transmitting portions of the plot data over a telephone line and modem form a mainframe computer, avter being read in from cards, to the desktop computer. This mode of operation was in fact utilized to a limited extent, but was not used for the bulk of the plotting. Instead the Fortran program which had been developed on the desktop computer was transmitted in Fortran source form to the mainframe computer over a phone line and complied on the mainframe computer. The program was then run on the mainframe computer, using one or the other of two options. One option, which was used in a limited fashion, involves operating the mainframe computer in terminal demand mode from the desktop computer, transmitting the output over the phone line to the desktop computer, then printing on the typewriter sized printer. This produces quite satisfactory plots and avoids the complexities of getting numerous sets of output data printed on white side of paper at mainframe installation. However, the large bulk of plots (about 200 pages) ruled against doing all the plots in this mode of operation. For the final plotting, we switched to printing as well as calculating with the mainframe computer, and use of suitable control cards, etc., to get plots on white side of paper. The plots still do not have as great a contrast as would be desired, since a fresh printer ribbon was not in use on the mainframe printer.

For performance of the various statistical analyses it was desirable to be able to access the entire "database" of results from some 200 calculations simultaneously. This ruled out direct calculations with the desktop computer which does not have that much mass storage available, although the resulting plots themselves can be transmitted over a phone line and printed on typewriter sized paper.

## VII. COMPUTER PROGRAM MFRSCHPLOT FOR SEARCHING OUT MODE FORMATION RESULTS AND PLOTTING THEM (AND MAKING STATISTICAL CALCULATIONS AND PLOTS)

When this computer program began, the intended function (as suggested by the program name, which is a mnemonic for "mode formation search and plot" was to search out selected sets of runs according to various criteria and plot them as a group. To prepare a plot in which the number of runs had produced results with that value would be represented by successive letters of the alphabet. This form of presentation enables one to readily visualize the statistical spread of results. It was desired that various sets of selection criteria could be used. Specific statistical calculations and plots were later added to the program and are an important further function.

The first type of selection criterion was the identifying "run number", RUNNO, which had been assigned to each mode formation calculation as a sort of "pseudo serial number" identifier. An input data parameter, SRCHRN, of type LOGICAL, is read in at essentially the start of MFRSCHPLOT execution. What its value is ".TRUE." the program reads in a set of run numbers which are to be located, and then proceeds to locate them.

The second type of selection criteria is used whenever the input value of SRCHRN is ".FALSE."; in such cases the computer reads in a set of test values of five parameters. These paramenters are TXNF2, TXMAG1, TEPSE, TXNMIR, and TYSEED, the initial "T" denoting that they are test values for variables which are as given by the remainder of the test variable name. For instance, the value of TXNF2 (assuming it is greater than a certain fraction, 0.001), is the test value for the variable XNF2, which is one of the identifying variables contained in the "database" which consists of defining parameters and results of mode formation computer calculations, To ignore any member of the set of test parameters one merely assigns it a value of -1.0.

With this program design one can readily select for consideration all runs which agree with any specified set of test variables which are included in the overall set of five. As a special case one can set all five test parameters to -1., in which case the program will select all members of the set of computed results for further consideration. The requirement that selected runs shall satisfy more than one criterion is accomplished by use of a set of logical variables, L1, L2, etc. and use of the logical ".AND." function of all five. Each parameter for which the input test value is negative produces a ".TRUE." value of the corresponding logical variable, as also occurs for each case of a numerical match.

The principal interest is in the second of the two above described selection criteria, and the remainder of this discussion will be limited to that case. The total number of "matches:, of computed results which agree with the test parameters as mentioned above, is counted and assigned to the variable TOTNOM. Account is kept of the runs which are selected by assigning values to a array MATCH(I), where I range from 1 to TOTNOM. The value of MATCH(I) is the first index of the doubly subscripted array of sets of results which form the "database." For instance if the second of the sets of results which "matches" a given set of test variables is the seventh of the overall sets of results, then MATCH(2) is set to 7. By use of MATCH(I) as a set of array indices, the program can readily reference the appropriate data for later manipulations.

After having found the set of "matches", of runs which satisfy the desired criteria, the MFRSCHPLOT program proceeds to print a list of the run number which have been selected, and also a list of all the identifying parameters (XNF2, etc.) for the selected runs. It then generates printer plots of combined results for this set of runs, listing in the printed figure caption the number of computer modelling runs which are bieng represented and the selection criterial which have been employed. Two plots are produced, one for the peak value of relative far field intensity, the other for the angular position of the peak. The plots naturally have the general appearance of individual plots produced by the MFLPP and MFLPQ printer plot programs. Instead of using a single character (X or.) to represent a single result, these plots use various letters of the alphabet to represent the number of runs for which the results fall with the specified (necessarily discrete) range. Thus a letter "A" appears at any position where one and only one mode formation calculation has produced a result with that value, the letter "B" appears where two calculations have produced a result with that value. Such "combined plots" are always produced, i.e. no input parameter is used to specify whether to produce sudh plots or not.

The second type of calculations and associated set of plots is optional, being controlled by the input parameters STATSC (mnemonic for "statistical calculations"), STABLE ("statistical table"), and SPLOTS ("statistical plots"). The associated calculations, print of table, or plot is performed only if the input parameter is zero.

Statistical calculations are performed by a subroutine MEANSD (mnemoinc for "mean and standard deviation") if STATSC is zero. The mean and standard deviation of the intensity and angular position are separately calculated for each value of the independent variable, closely related to number of round trips in the resonator. Intensity and angular position calculations are carried out by separate calls to the subroutine.

If STABLE is zero, or blank on the input data card, a table giving the mean and standard deviation for both intensity and angular position is printed.

If SPLOTS is zero, separate printer plots are made for intensity and angular position, each of which displays the value of the mean by the letter "M". The statistical uncertainty of the set of results is indicated by printing the letter "S" at positions corresponding to one standard deviation more and less than the mean value, except that it is omitted if it would fall outside the plot. Dots are used to fill in the space between the letters "S" and the "M". Such plots are perhaps the most informative of all types of display we have used in this work.

## VIII. DISCUSSION OF RESULTS

The collection of results of mode formation modelling calculations is perhaps most readily visualized by reference to the several plots of the type which are labeled as "combined results"; such labelling easily distinguishes them from plots of individual calculations, which are labelled at "Run XXX." These are of two subtypes, which will be referred to as scatter plots and statistical plots. The two subtypes are not explicitly distinguished by their labels.

For each of these combined results plots, the independent variable represents twenty times the normalized value of the round trip number. For example, an independent variable value of 32 corresponds to a number of round trips which is just equal to 1.6 times the nominal value (ratio of logarithms of tube Fresnel number and magnification). This is different from the independent variable used in the plots of individual caculations, and permits meaningful inclusion on the same combined results plot of results obtained for various combinations of resonator parameters. The dependent variables, IP/IO and THETA, range from 0 to 1.0, and from -5.0 to +5.0, respectively, as in the plots of results of individual runs.

In the scatter plots a measure of the "density" of values is indicated by successive letters of the alphabet, with "A" corresponding to the fact that only one run of the group considered produced a value within the discrete range involved, the letter "B" corresponding to two such runs. Separate scatter plots were produced for IP/IO and for THETA.

From the scatter plots of IP/IO one can readily discern a pronounced statistical variability in the earlier stages of the mode formation process. In fact, there is still considerable spread for values of normalized round trip number for which the IP/IO values are clustering about a moderately large value, say 0.80. From inspection of the full set of such plots one might perhaps subjectively conclude that the transverse mode has achieved a resonably good intensity value within the nominal number of round trips, but there is scatter corresponding to a substantial fraction of cases which require a larger number of round trips for satisfactory mode formation as measured by relative peak intensity.

The scatter plots of THETA indicate a very broad angular spread in early stages, and suggest a monotonic decrease in angular spread as round trip number (and hence time) increases. One would perhaps subjectively conclude that the angular spread has become and remains moderately small after the number of round trips reaches its nominal value (20 units for the independent variable in tha scatter plots), but there is still a further noticeable decrease in angular spread at later times.

A more quantiative presentation of the statistical properties of the mose formation results is given in what we designate as the statistical plots. The data which has been obtained from "sorting" of the overall set of runs to find those which match specified sets of parameters has already been generated in preparation of the scatter plots. For the statistical plots there is a further stage of calculation in which the mean and standard deviation of all values falling at each selected value of the independent variable are computed; the mean and standard deviation are then indicated on the statistical plots. There is a separate plot for intensity and for angle (just as for the scatter plots). The character "M" represents the mean value. The character "S" is plotted at a distance above and below the mean which is equal to the computed value of the standard deviation, of course points for which the upper "S" would fall off the top of the graph are not plotted.

The statistical plots for IP/IO typically are concave upward for small values of the independent variable, then tend to be straight for IP/IO near one-half. and finally become concave downward. This can be roughly described as sort of "S" shape, through the curvature is smaller than one tends to associate with that letter. In any event, the trend is clearly monotonically upward, as one would certainly expect. Near the central part of the plot, there is no clearly discernible trend regarding the magnitude of the standard deviation. The standard deviation is relatively small for both extremes of the independent variable, as it would almost have to be. The statistical spread is still quite substantial, with a standard deviation of the order of 0.1, when the number of round trips has reached its nominal value. From the statistical plot for IP/IO obtained from the combined results of all 198 calculations, one would conclude that the mode is fairly well, but not fully, formed after a number of round trips equal to the nominal value.

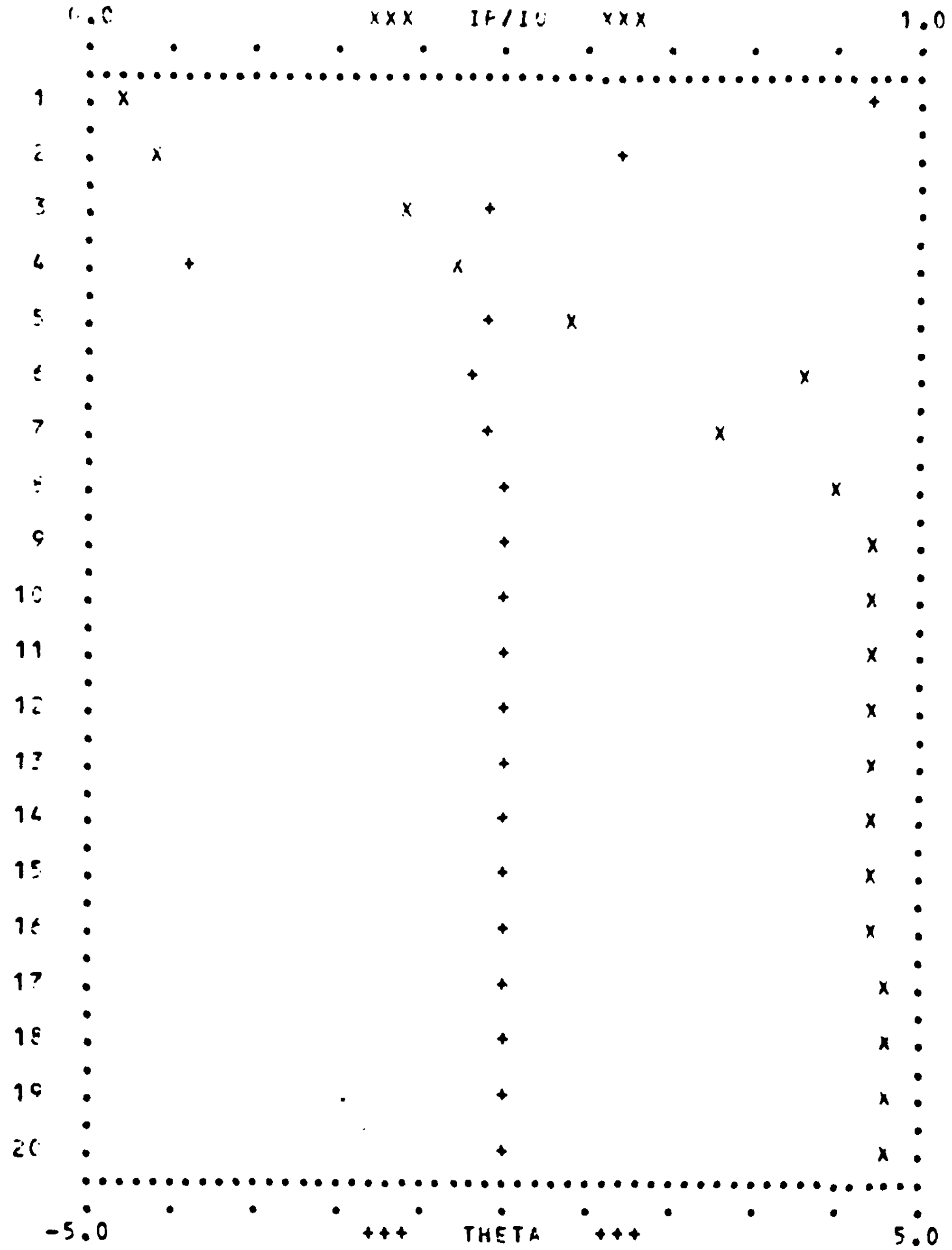
The statistical plots for THETA indicate a standard deviation of some three or four diffraction angles at very early times, and a monotonic decrease with increasing value of independent variable. The decrease in standard deviation apparently does not become pronounced until a substantial fraction of the nominal number of round trips have occurred. From the statistical plot ofr THETA for the combined results of all 198 calculations, one would conclude that the angular spread has become less than one diffraction angle after a number of round trips equal to the nominal value. This seems a fairly well formed mode, although the angular spread clearly decreases further.

The angular spread can be at least qualitatively fitted by a Gaussian function of normalized round trip number. The value of SDT(T), where SDT means standard deviation for angle THETA as a function of time T, can be expressed as

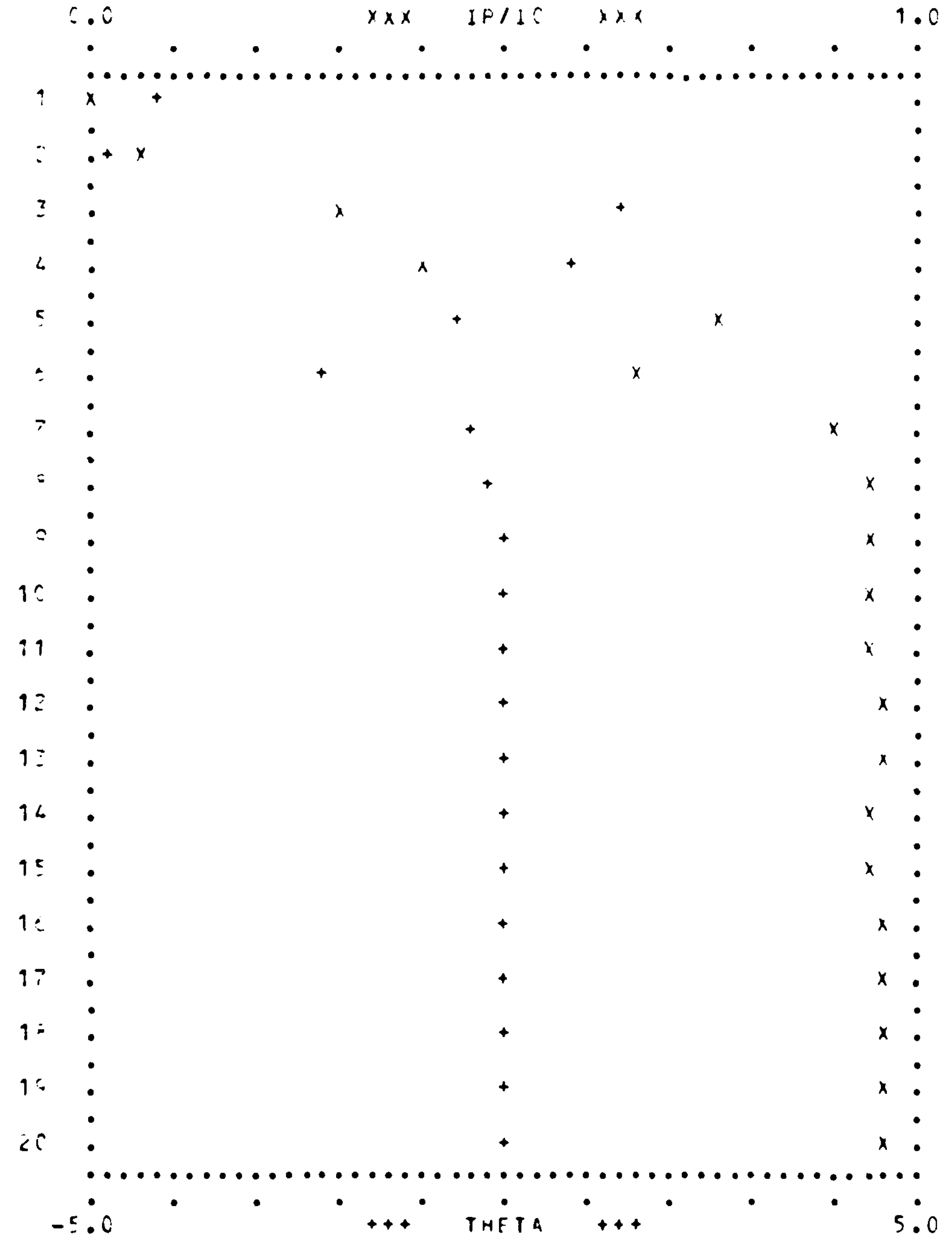
SDT(T) = 3.6 exp[-2(T/TN)**2],

where TN is the nominal time for mode formation. This predicts standard deviation values of 3.6, 2.2, and 0.5 diffraction angles at times corresponding to independent zero, one-half, and one times the nominal mode formation time, respectively. We emphasize that no quantitative curve fitting was done to obtain the above expression; it represents only an eyeball fit. The significant point is merely that the behavior of the plot is qualitatively similar to that of a Gaussian.

## IX. INDIVIDUAL MODE FORMATION CALCULATIONS




RUN 102. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 103. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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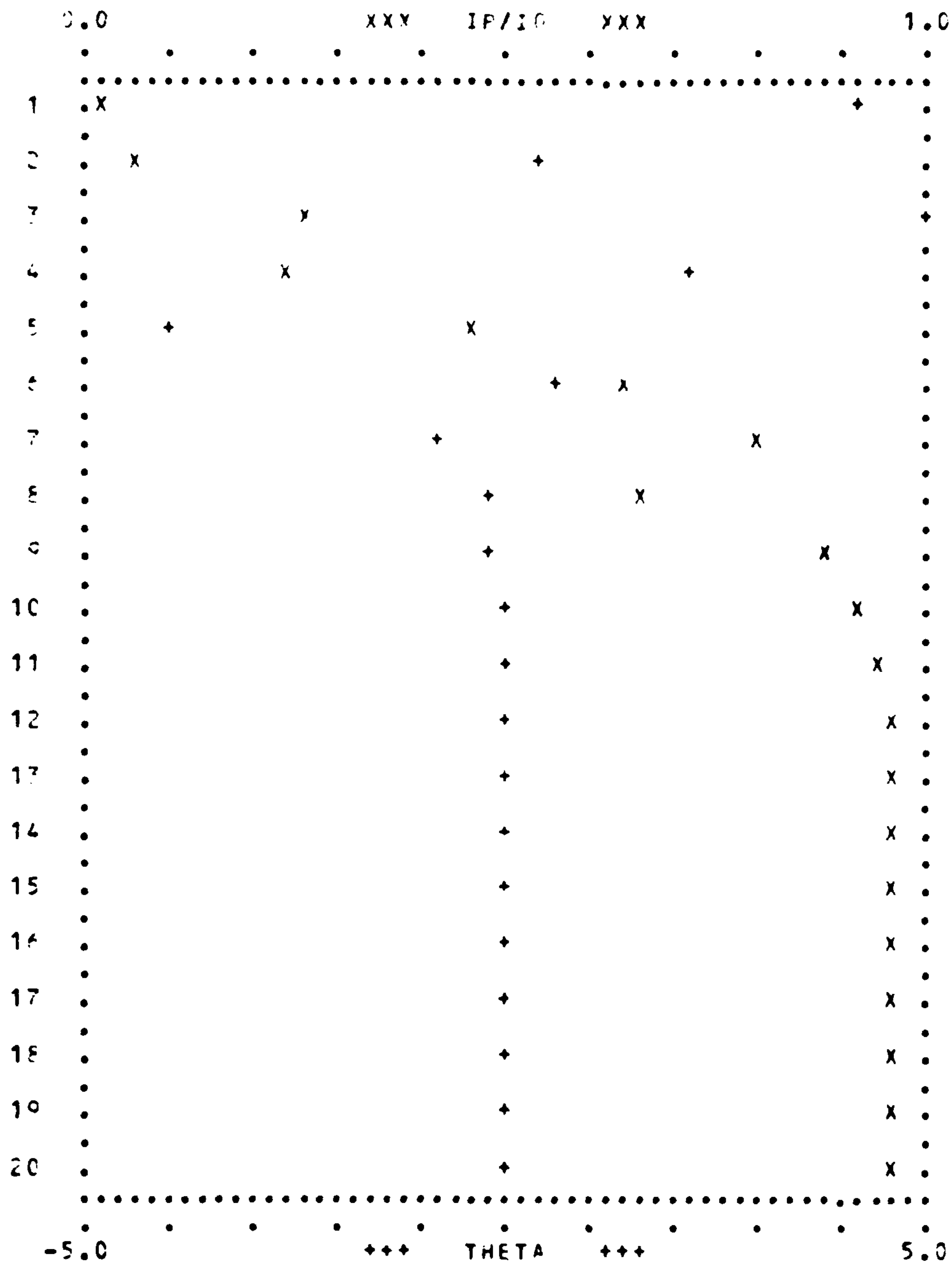


RUN 105. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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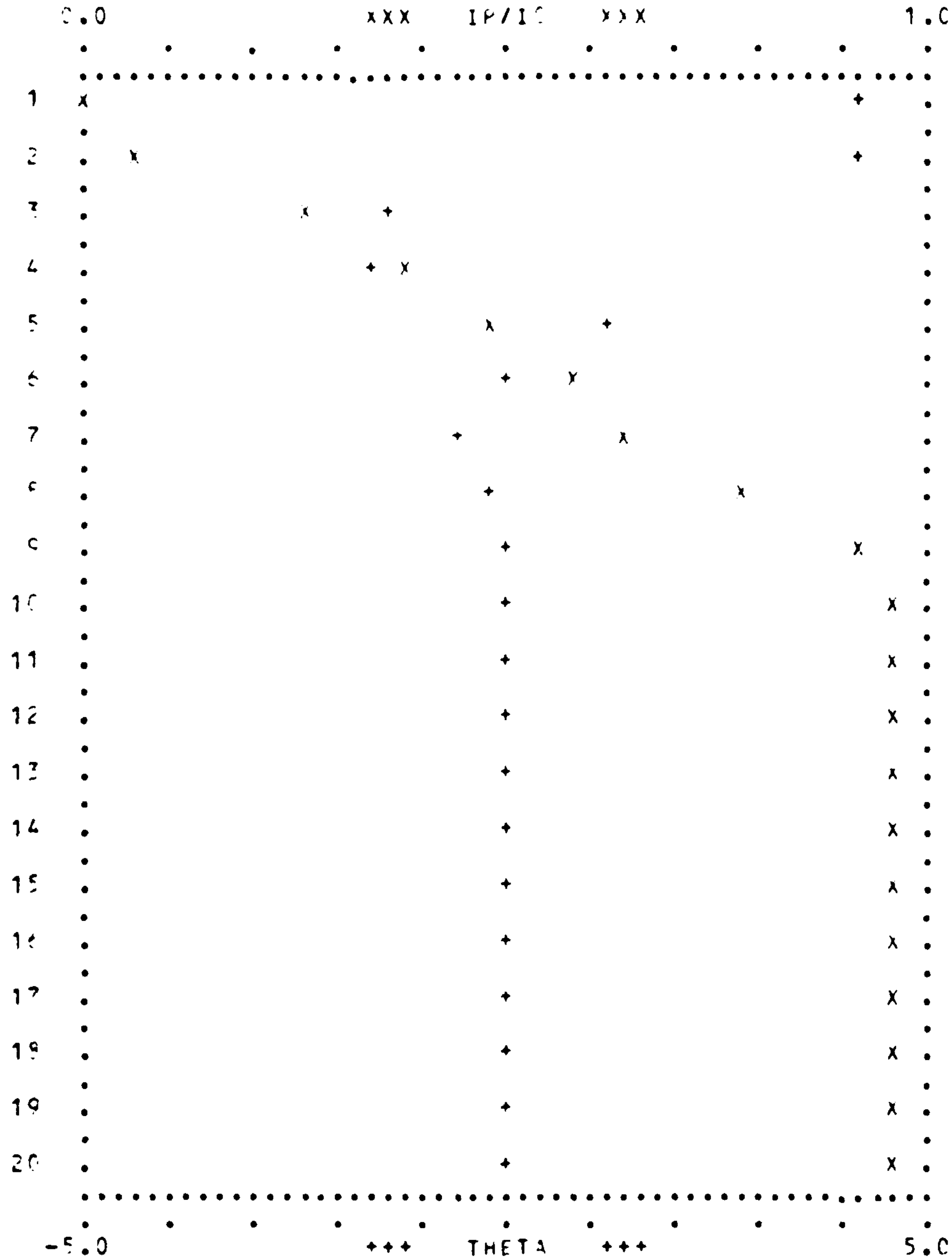
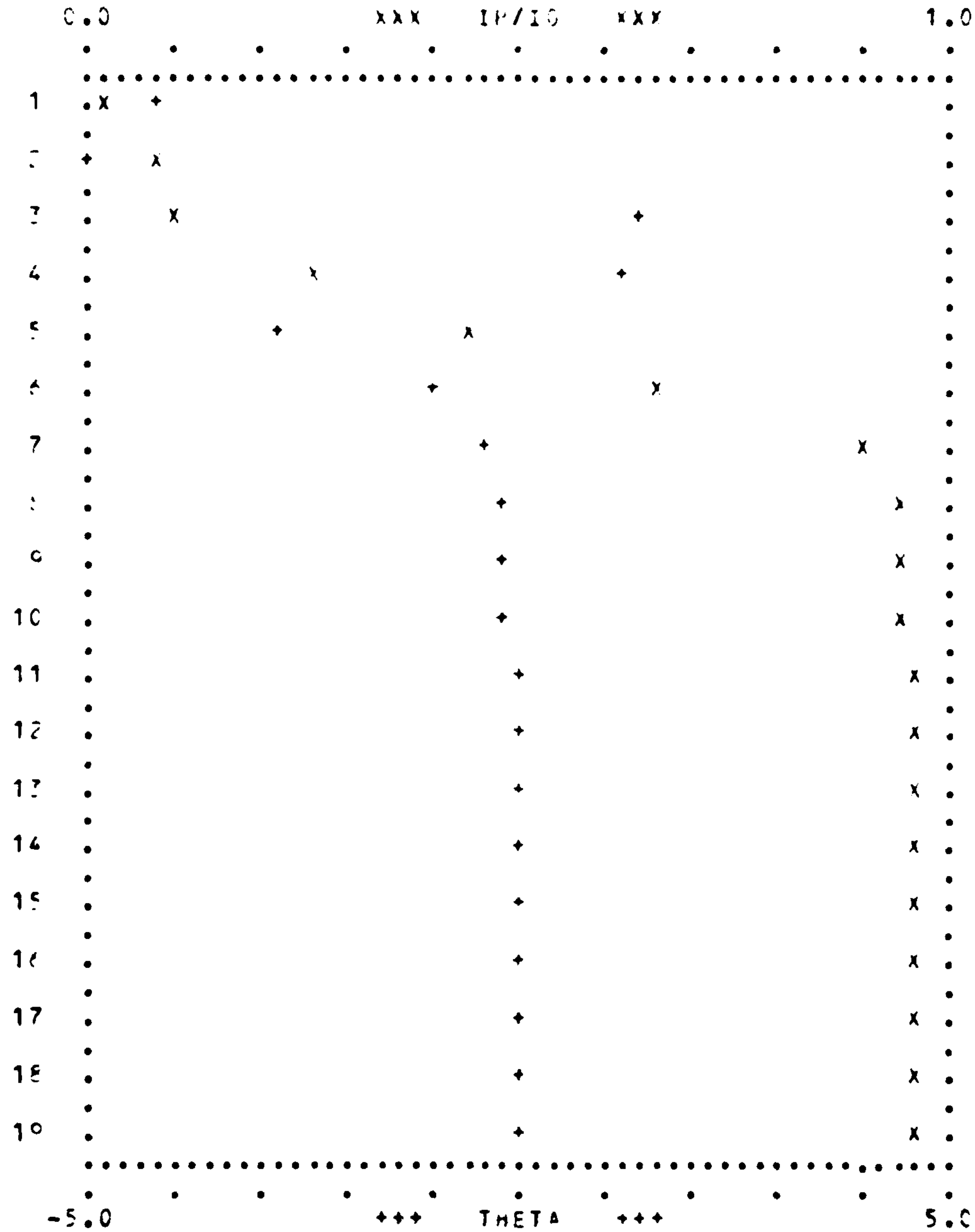
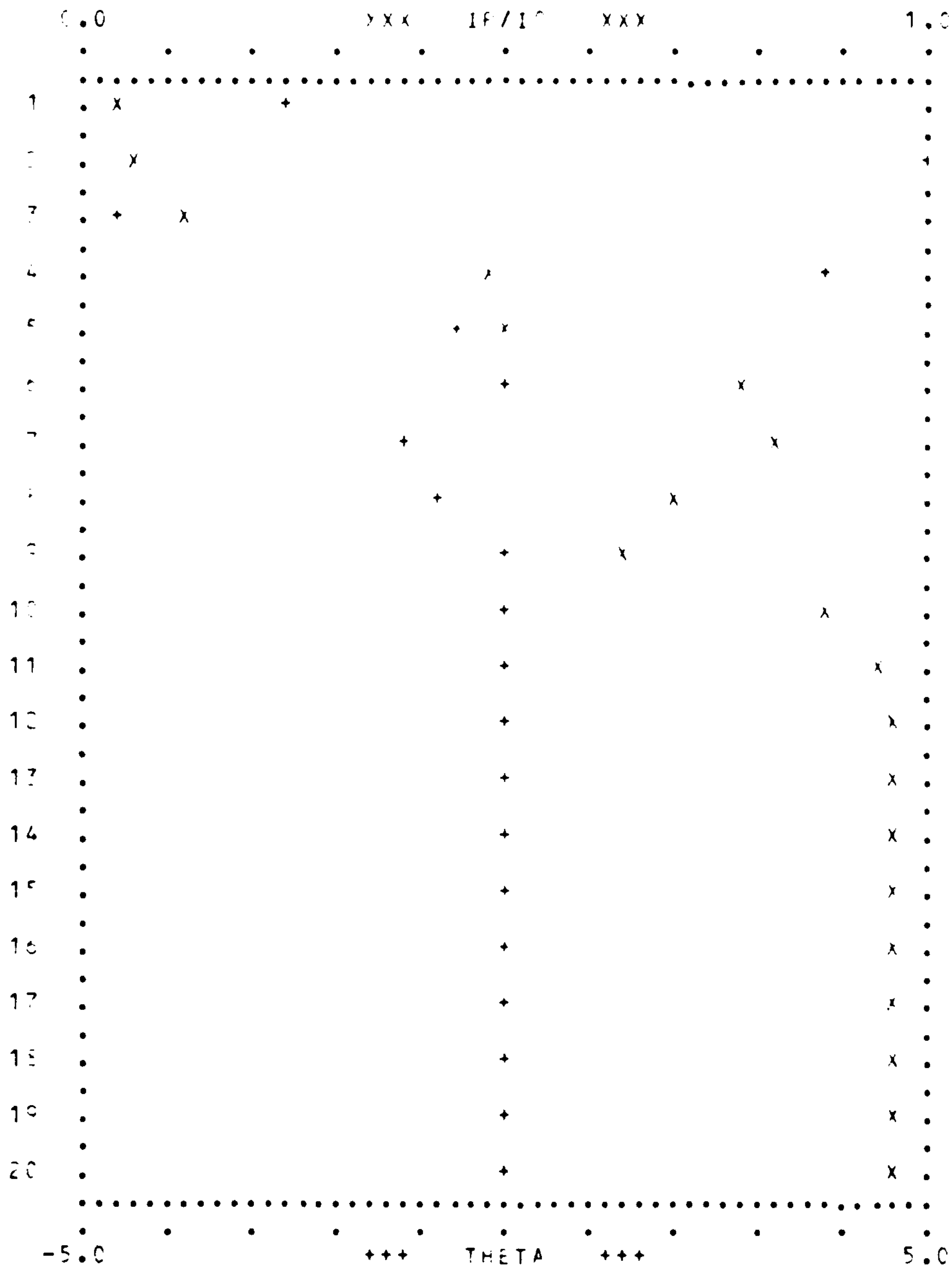


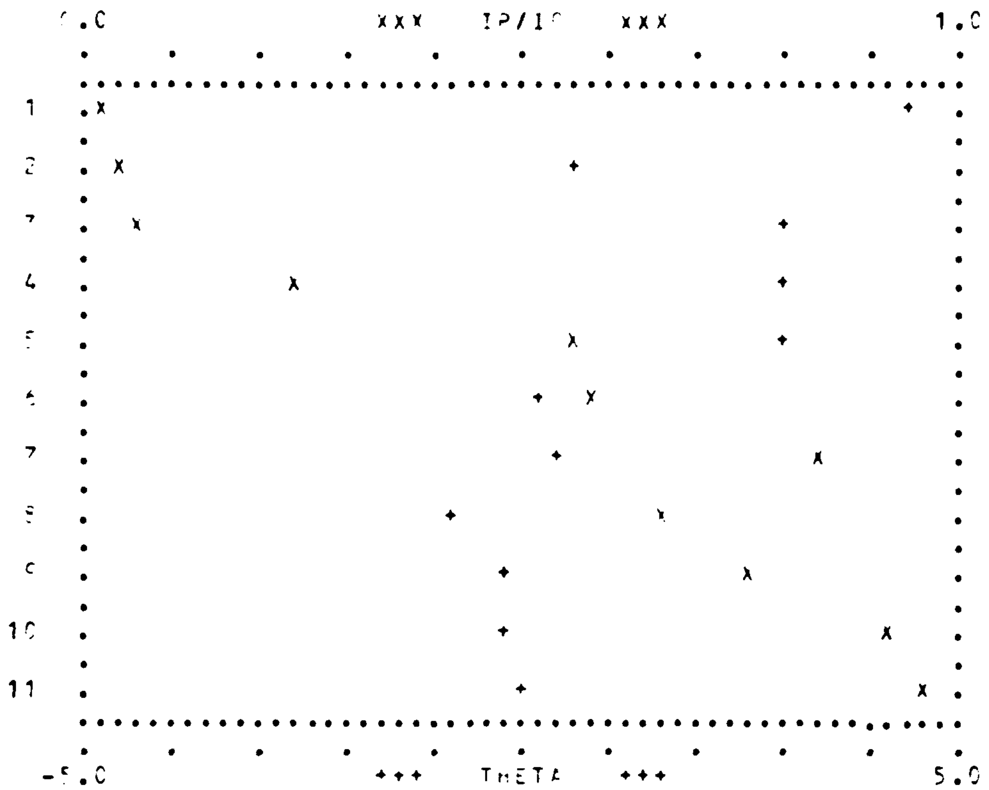

RUN 106. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00000 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 107. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 109. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 109. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IF/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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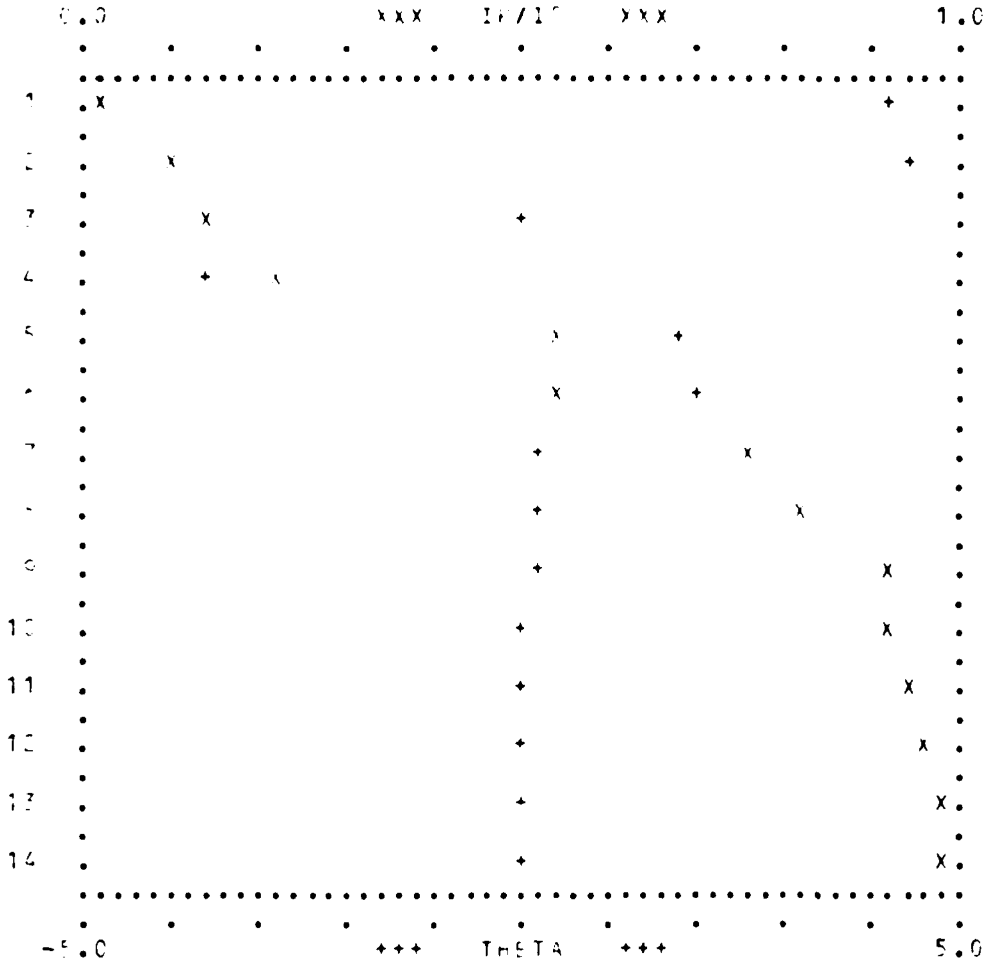
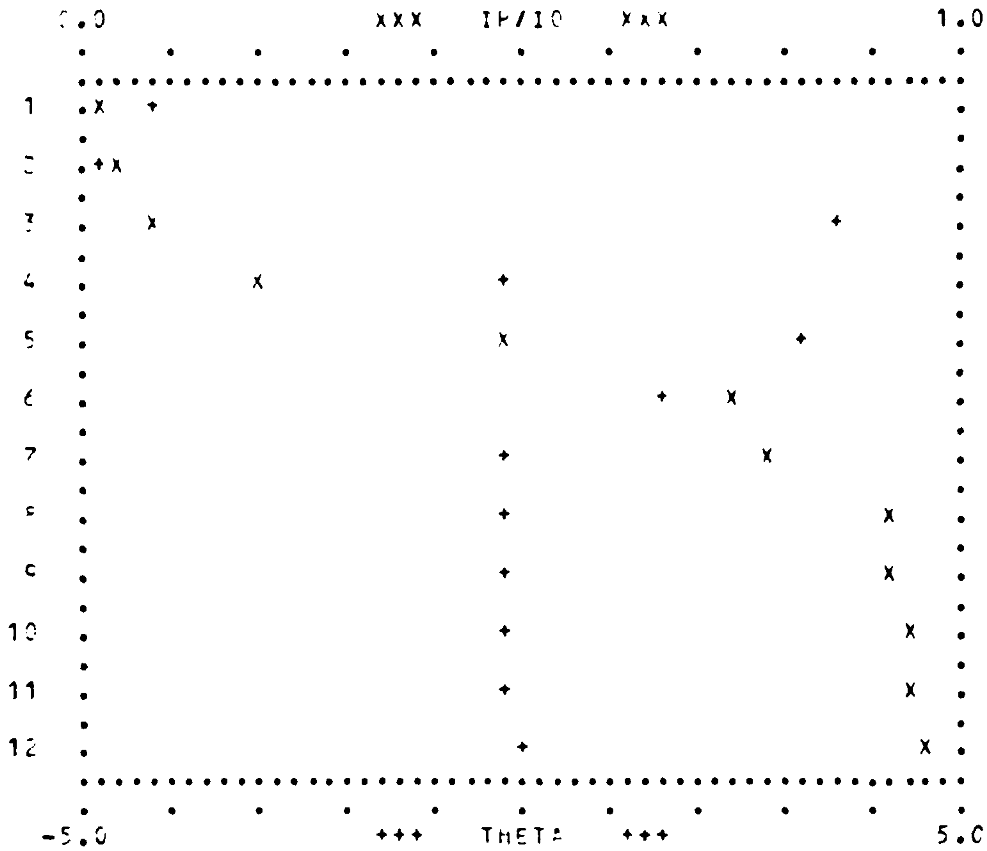



RUN 110. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 111. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
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THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFFACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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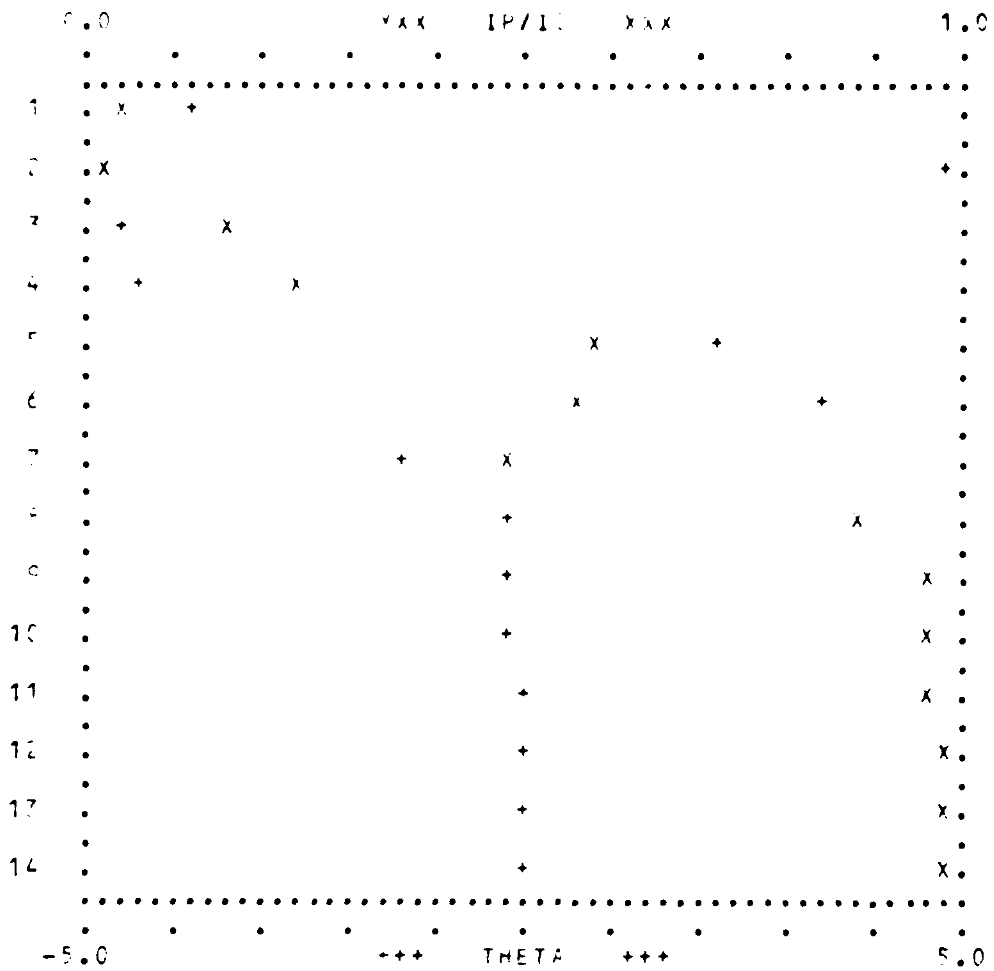
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 112. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
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THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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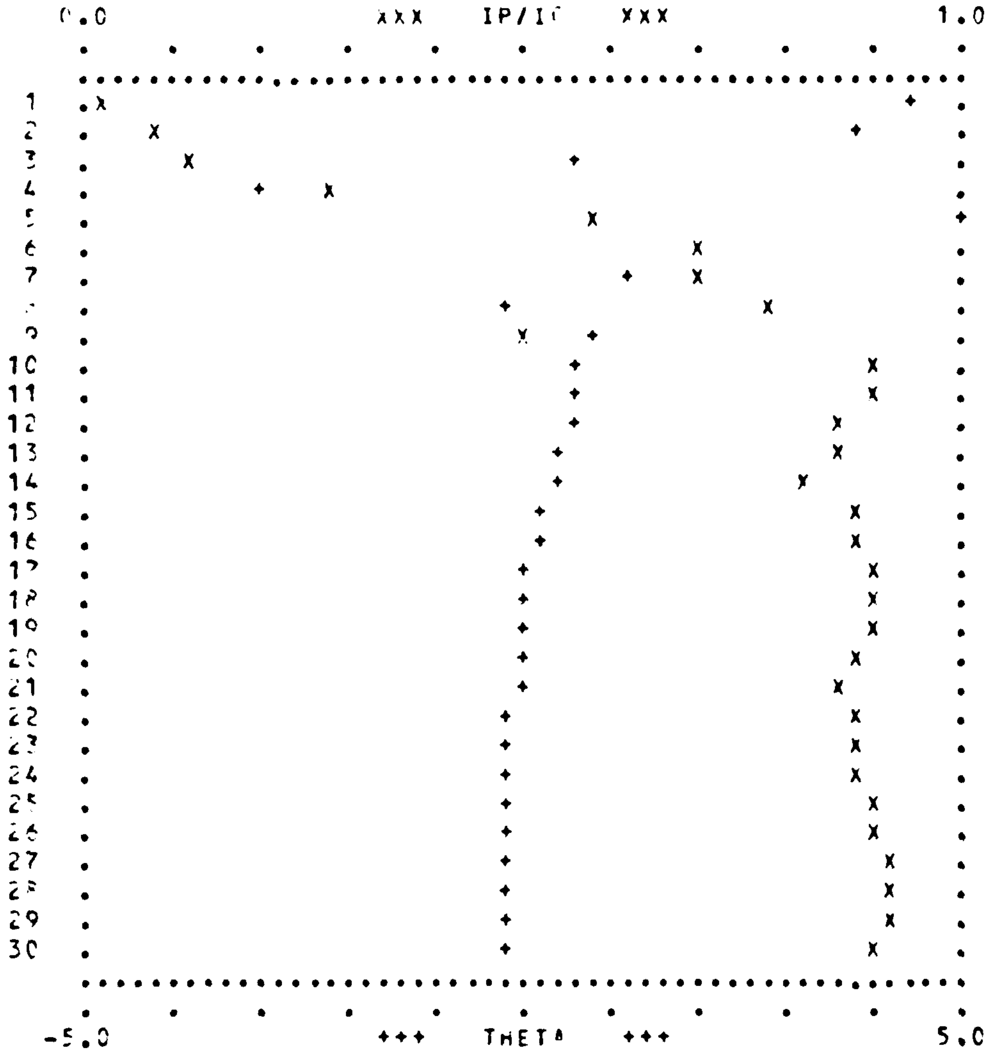


RUN 181. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
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THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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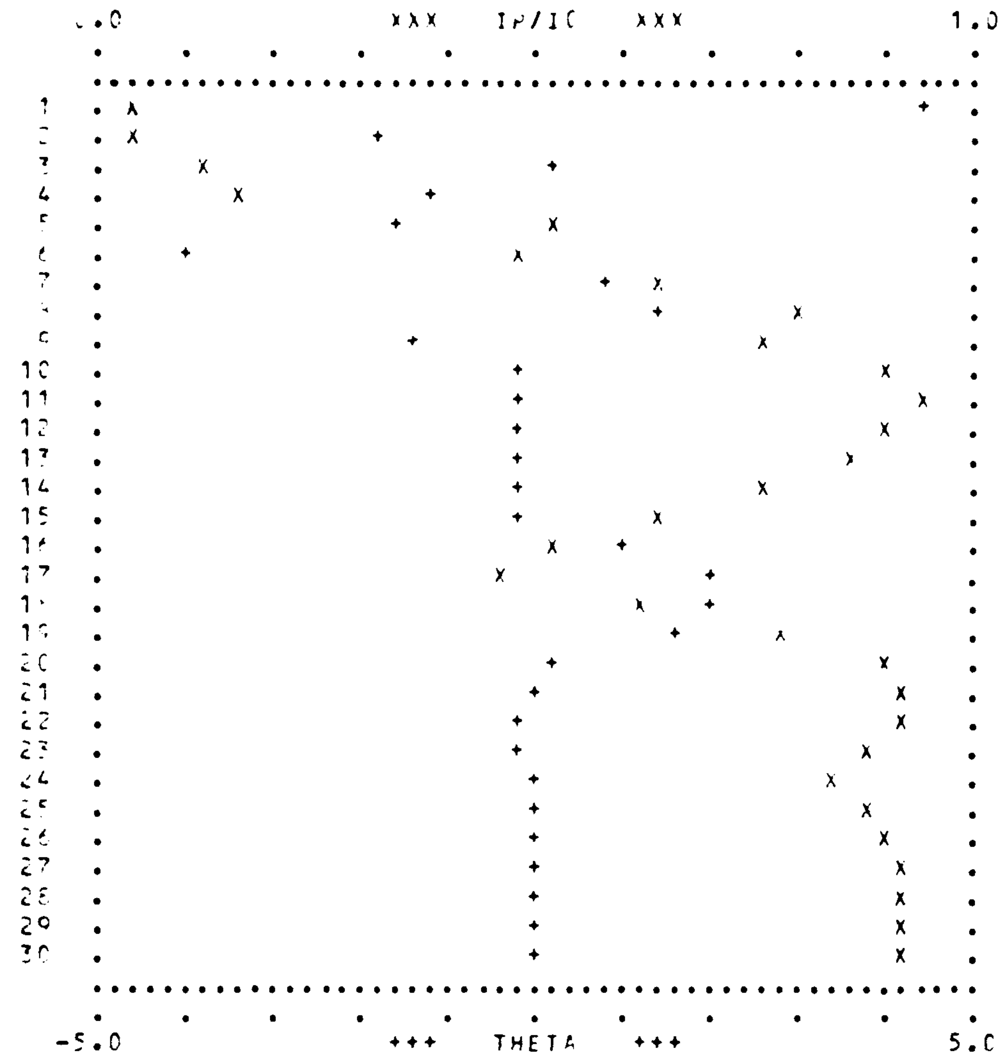


RUN 182. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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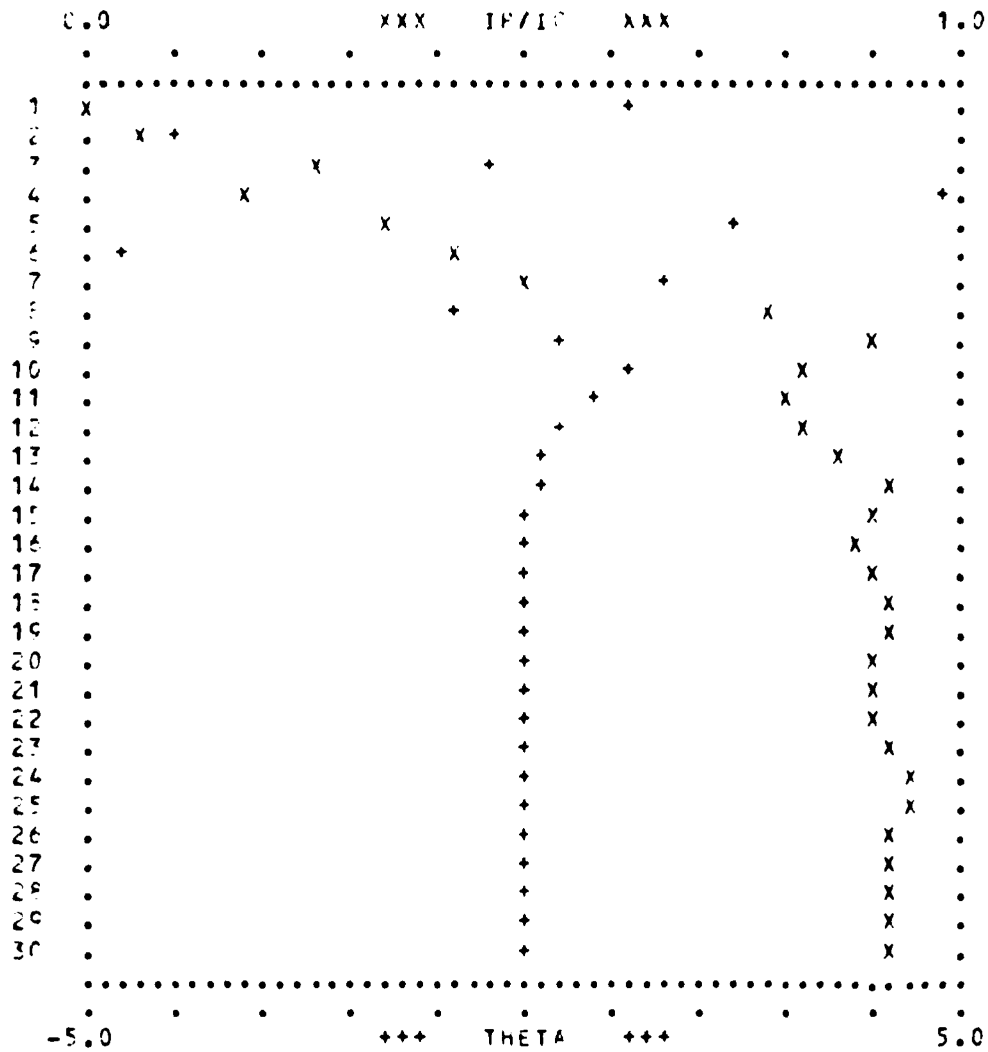
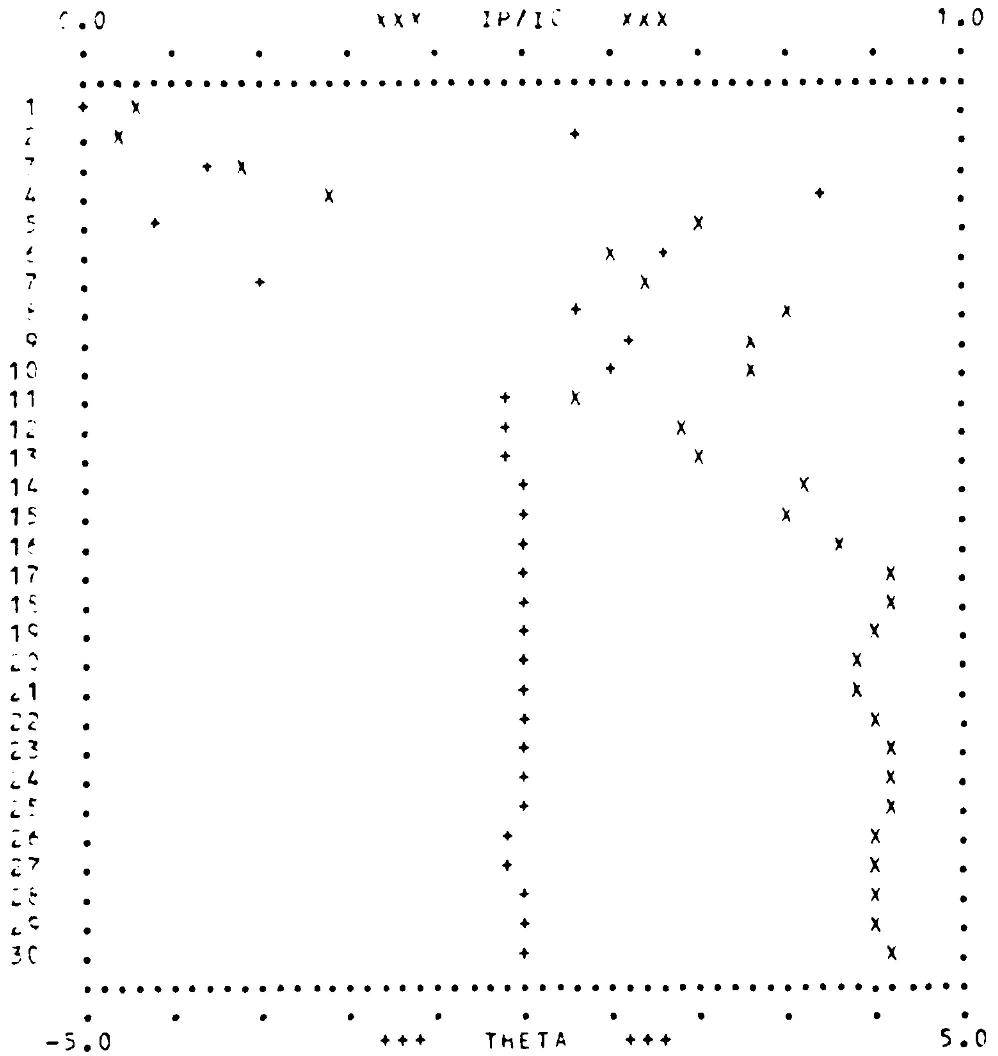



RUN 187. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 184. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.41417
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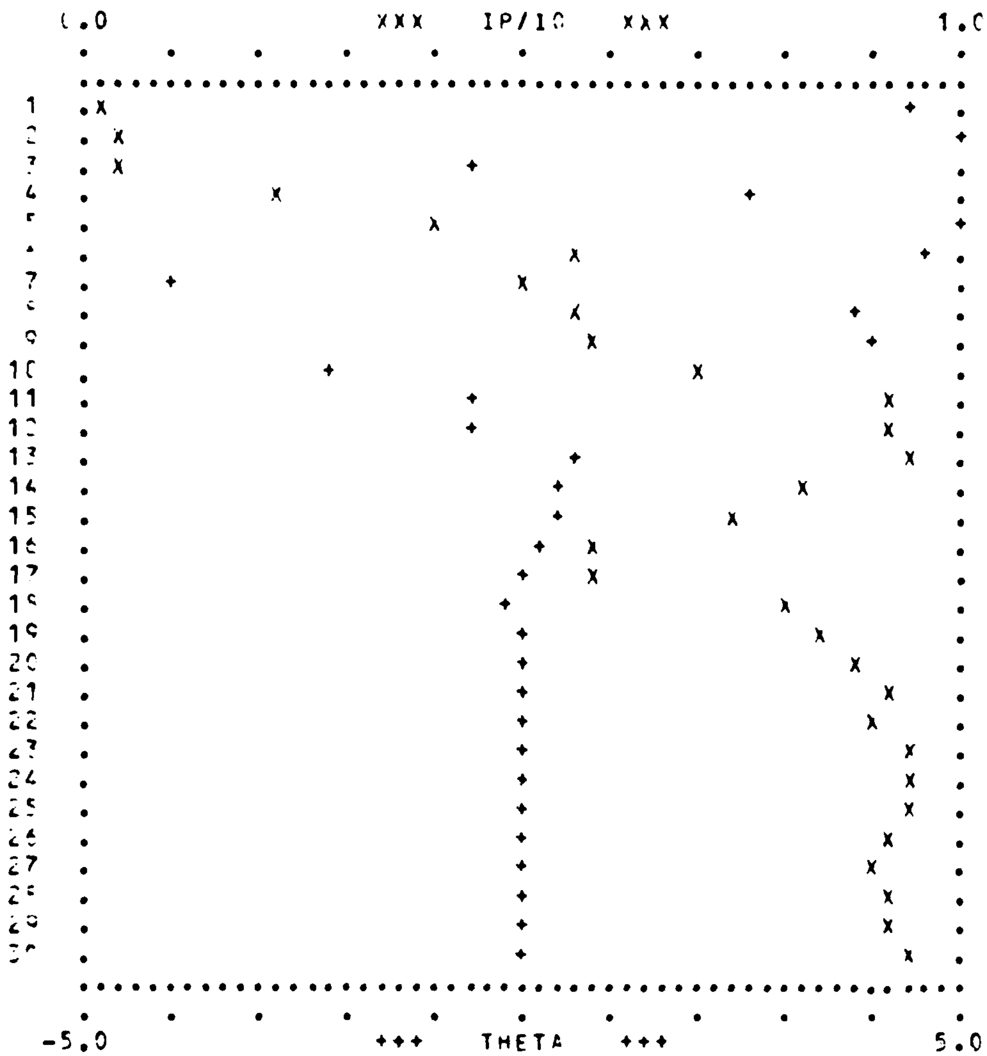
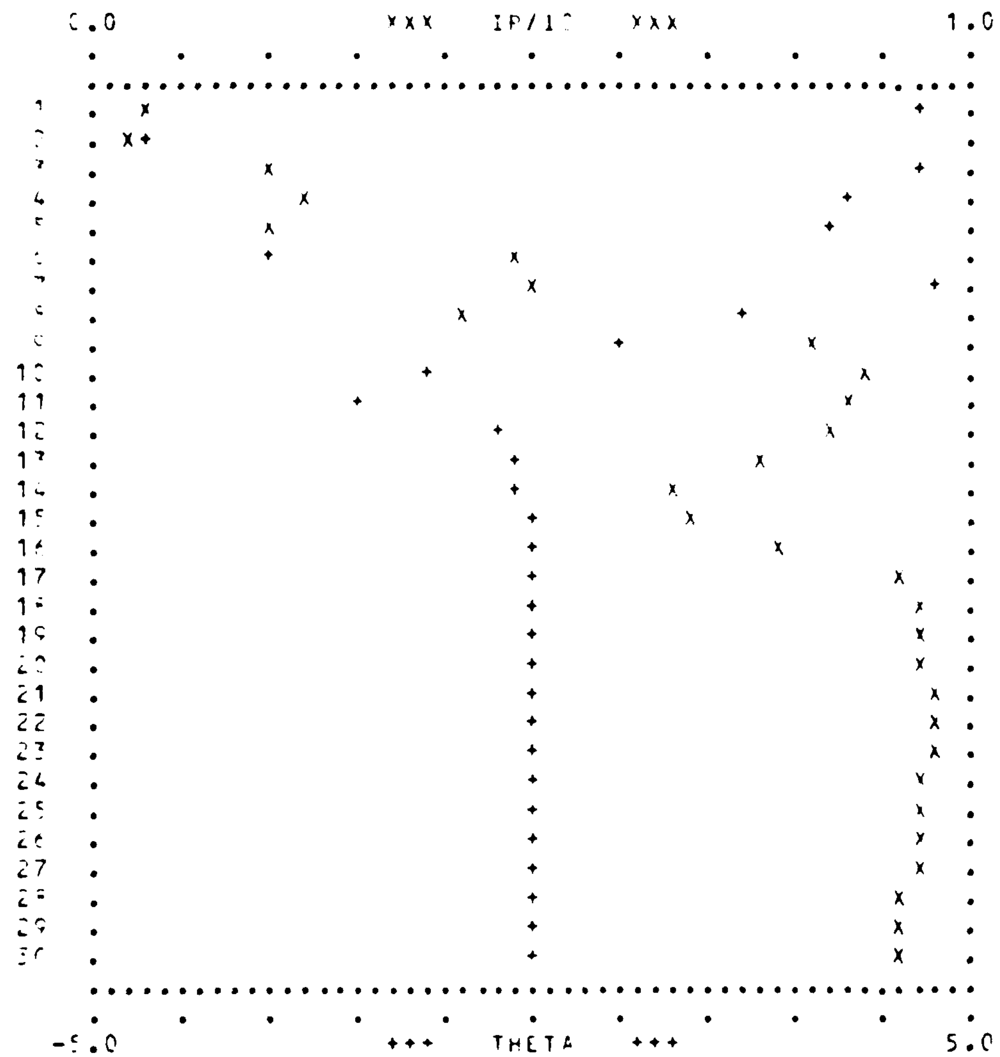
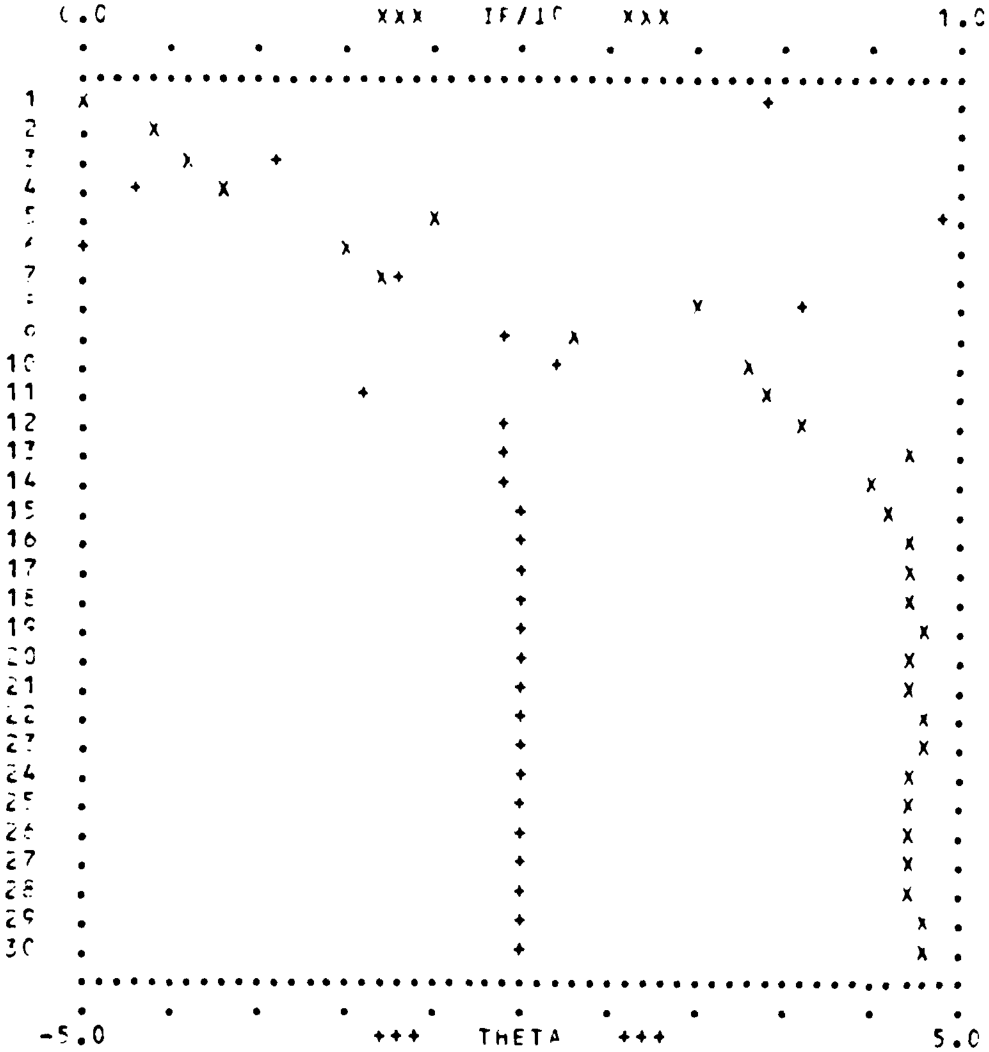



RUN 185. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 186. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 167. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
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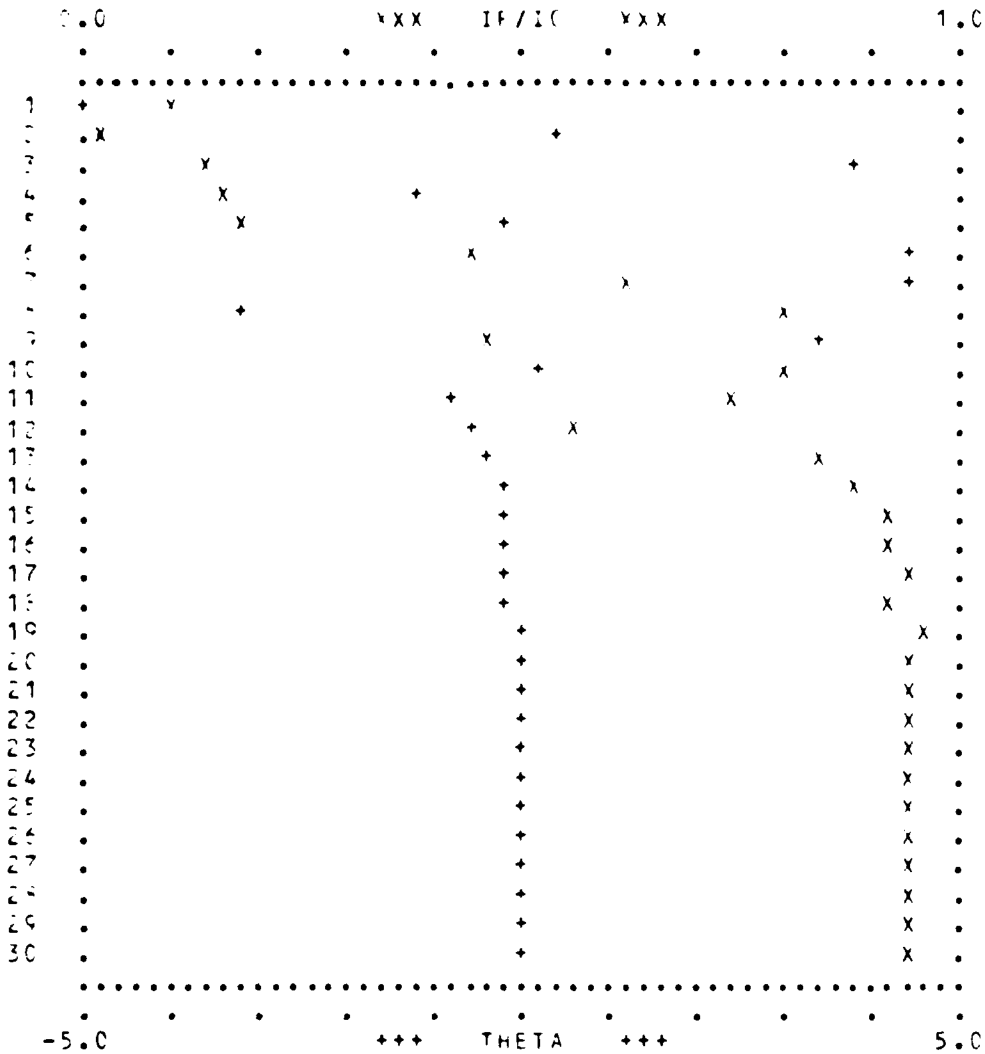
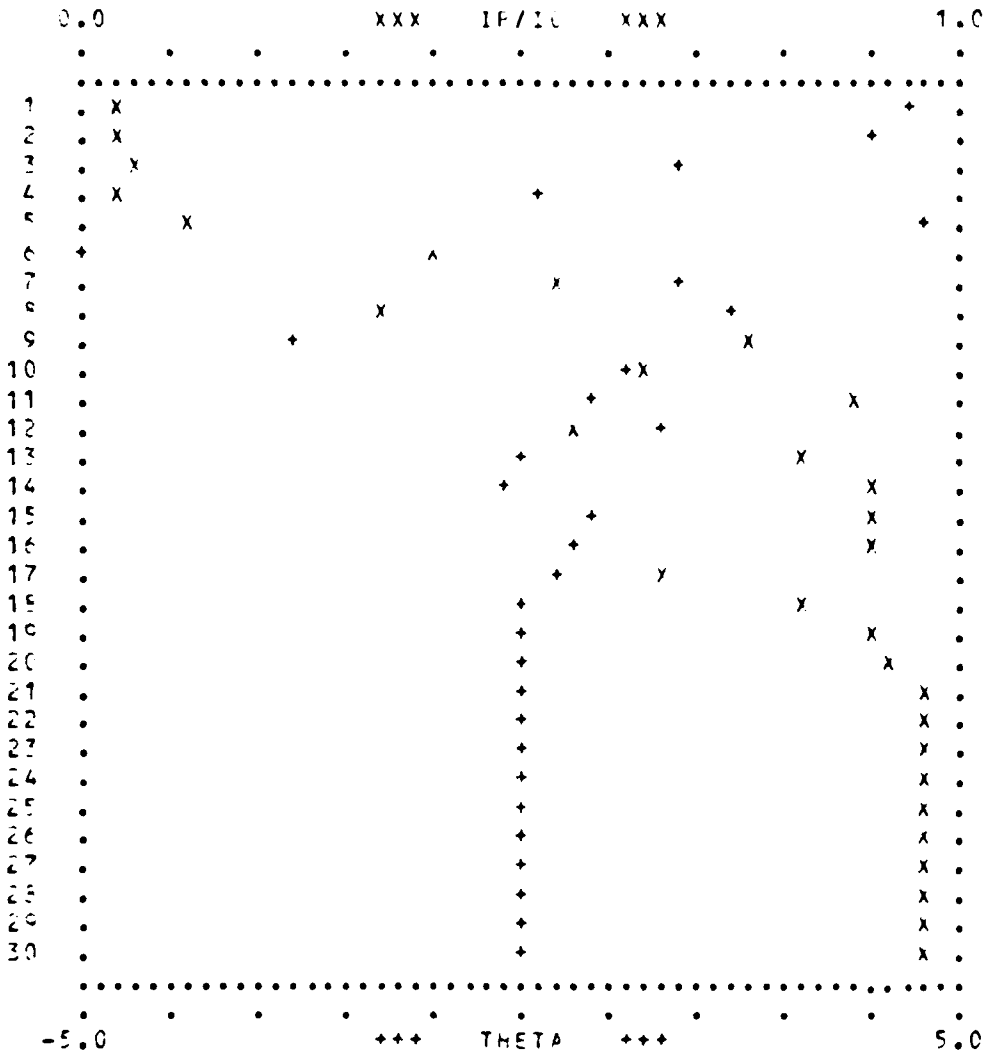
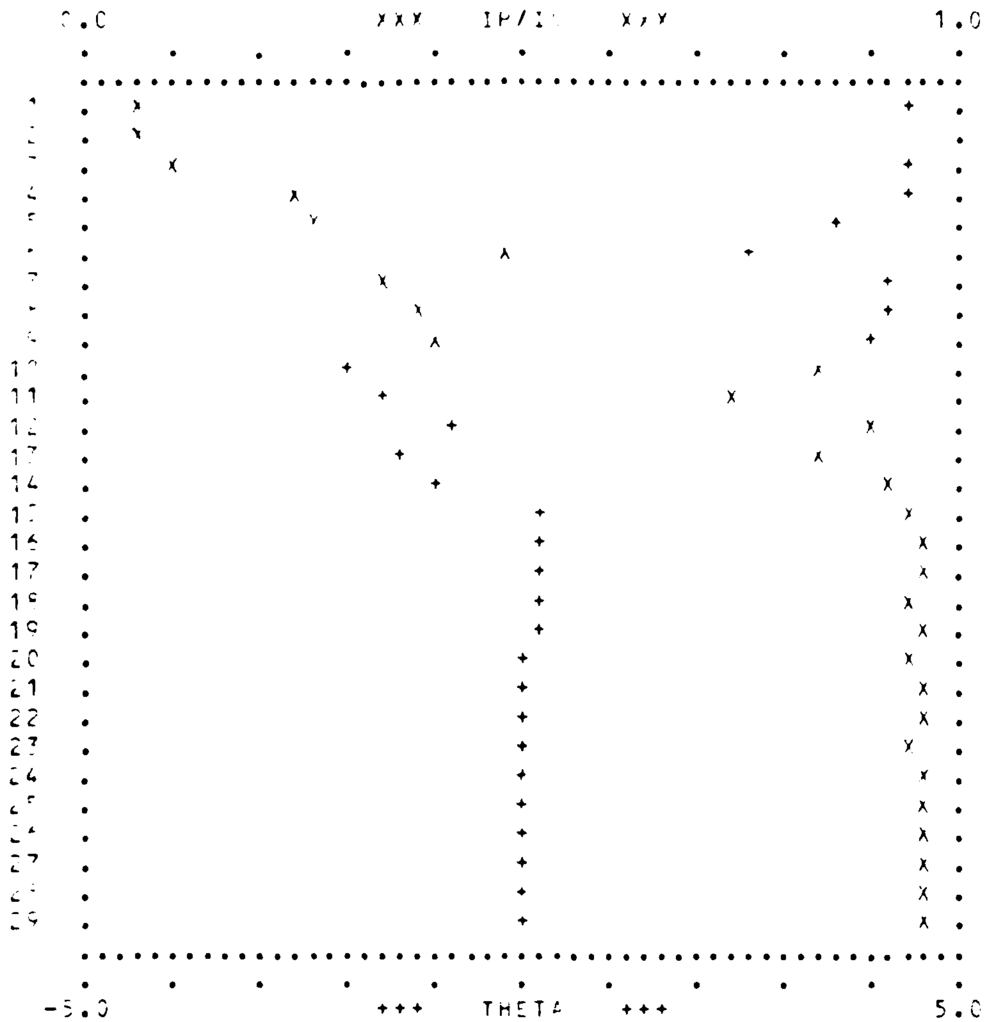
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



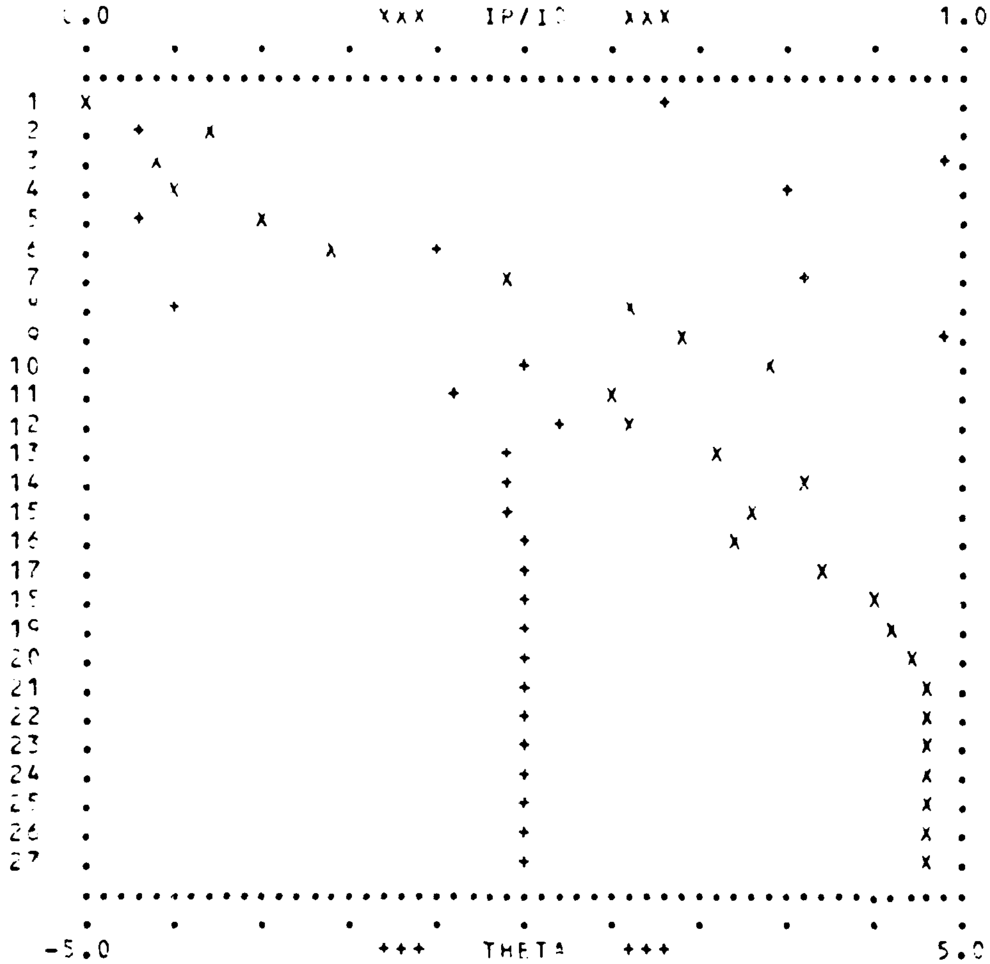

RUN 188. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



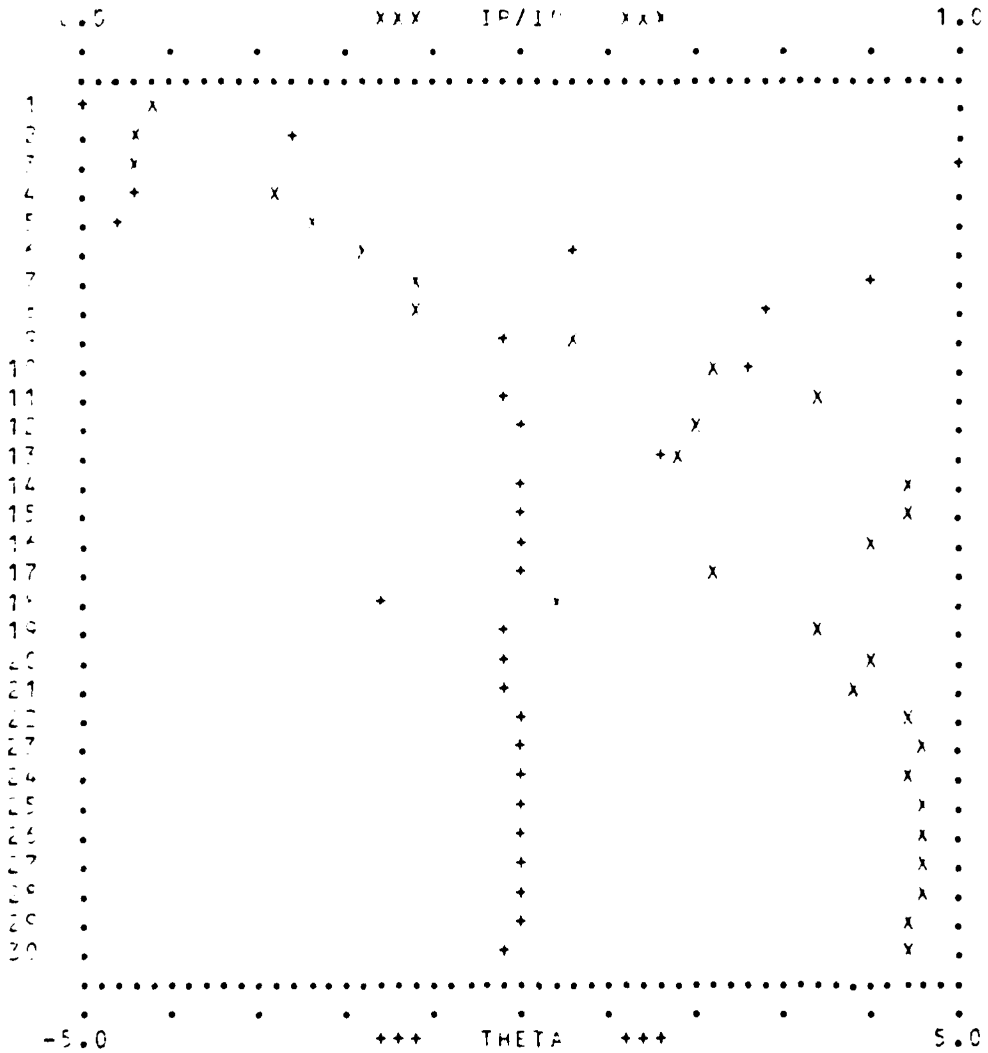

RUN 189. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 707.20000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



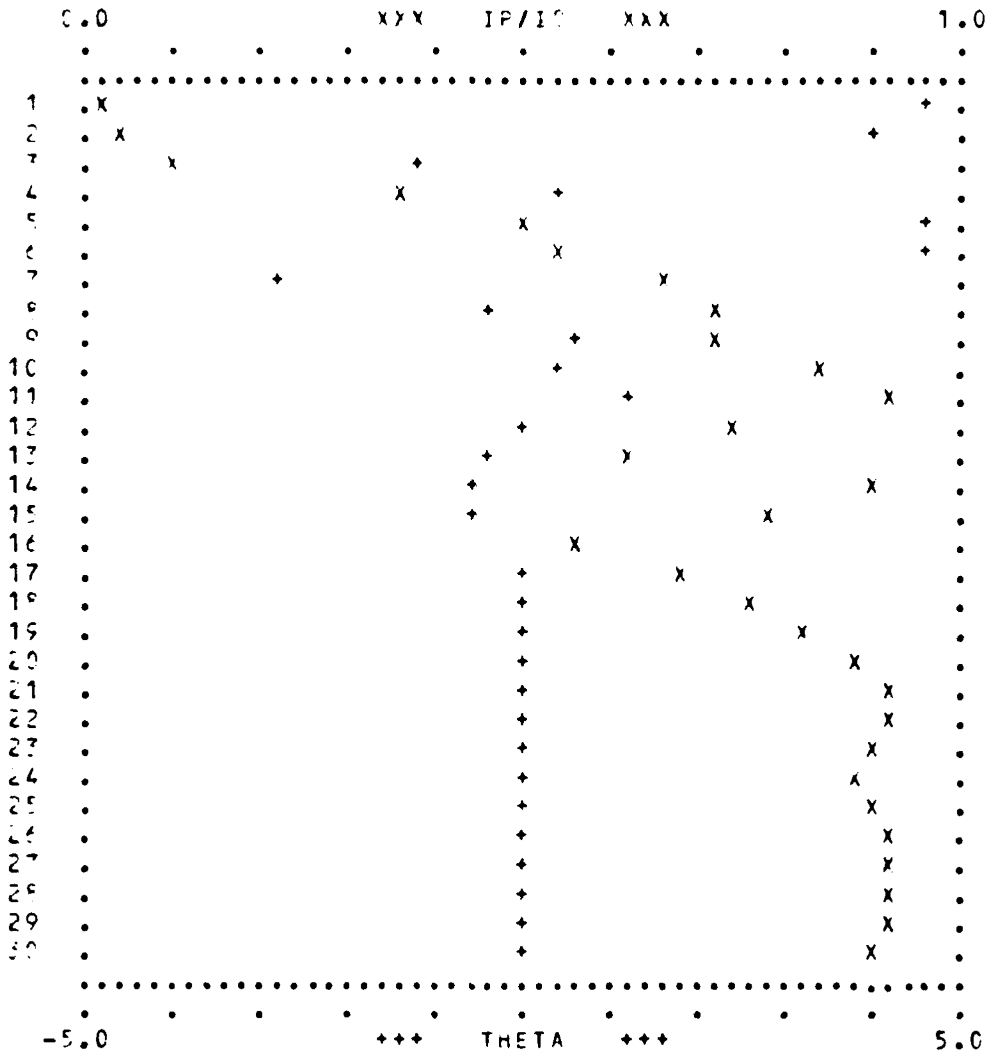

RUN 190. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



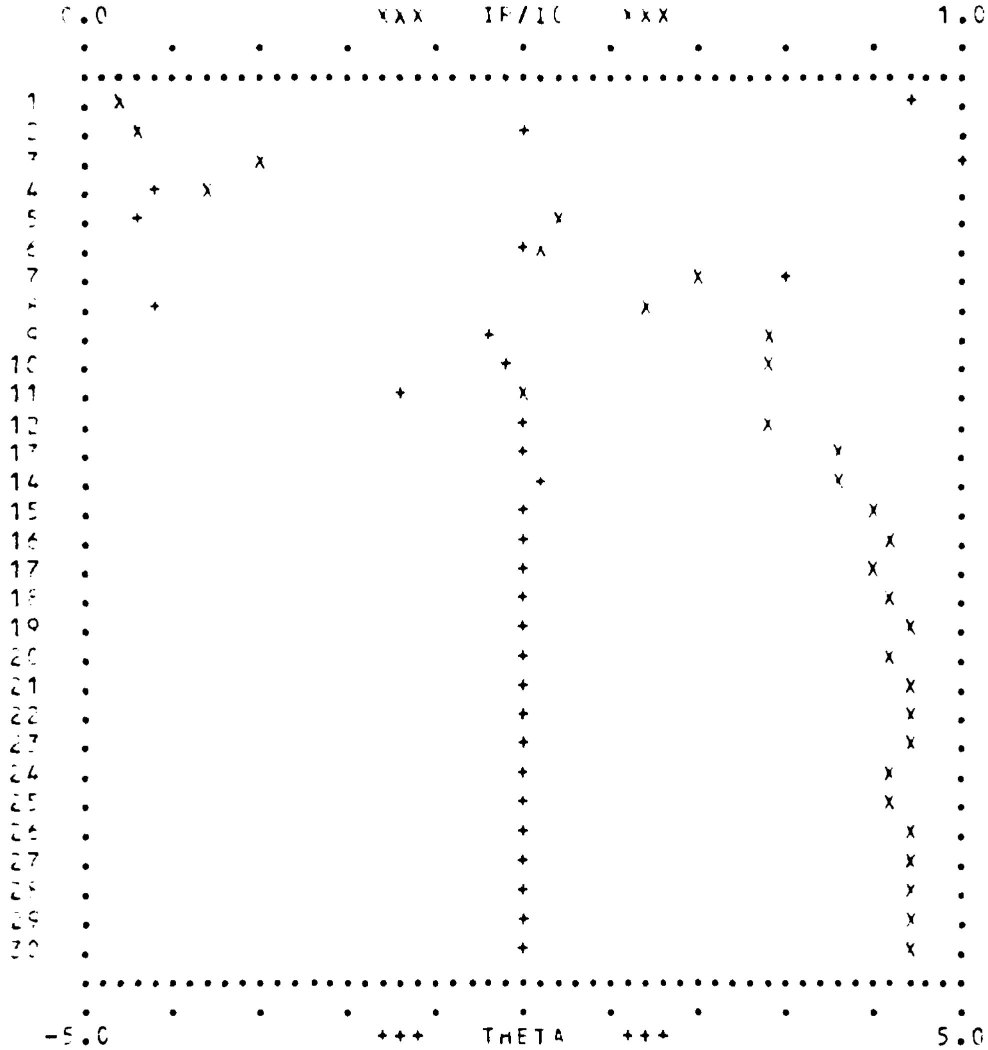

RUN 191. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.




RUN 192. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.

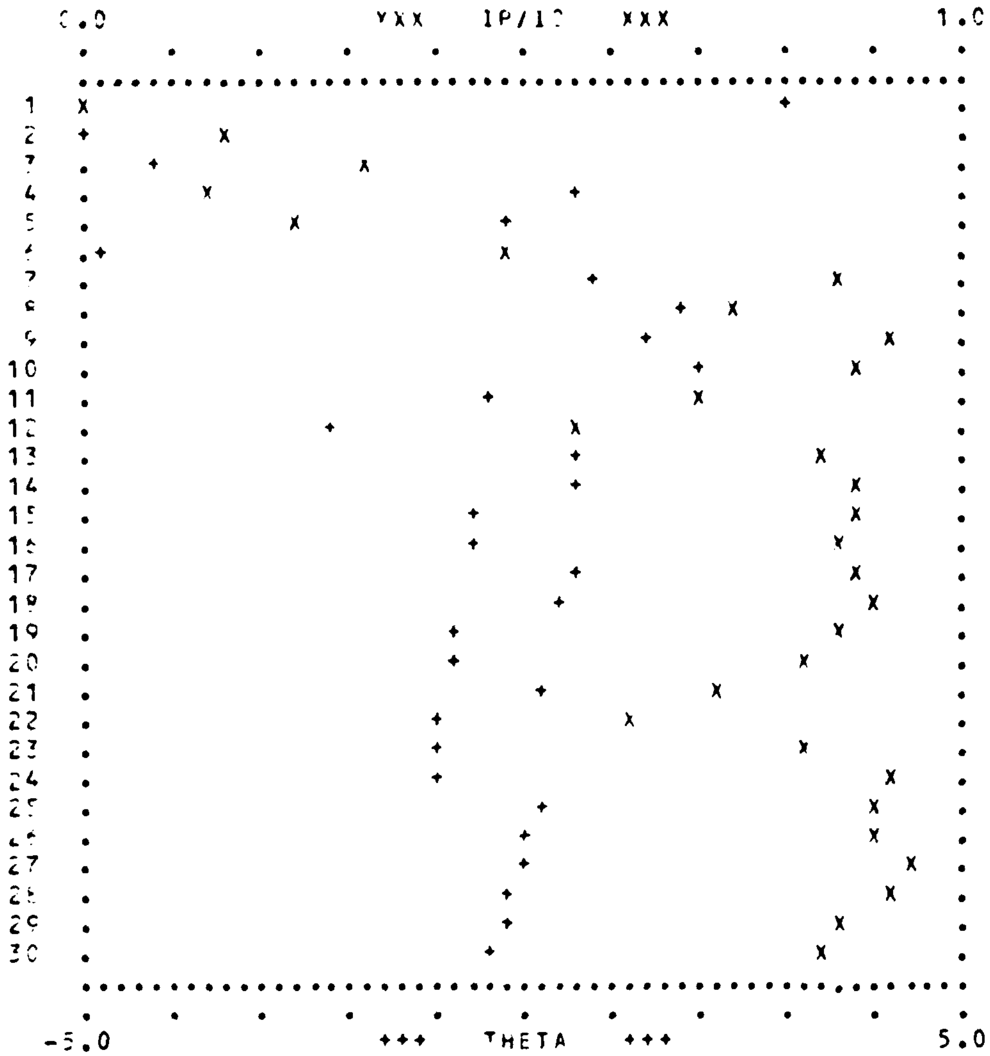



RUN 201. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.

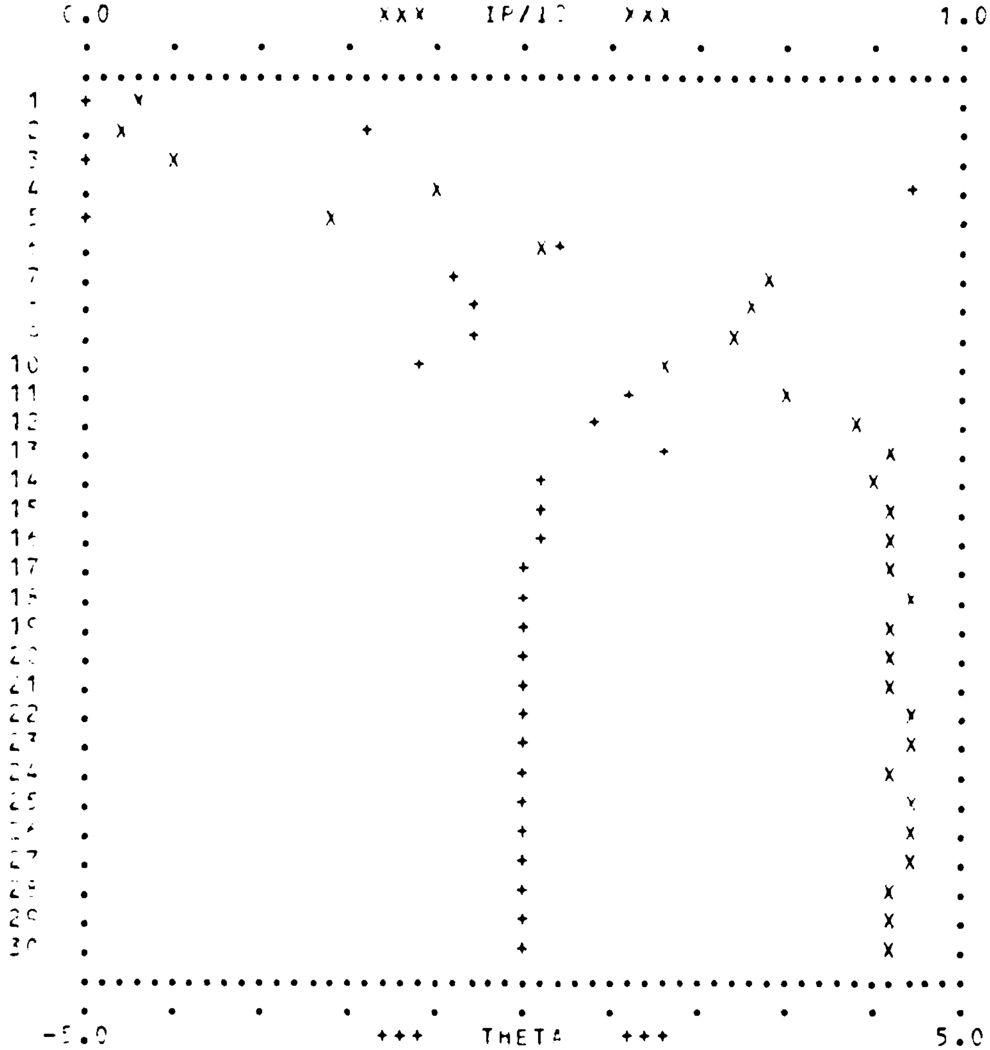




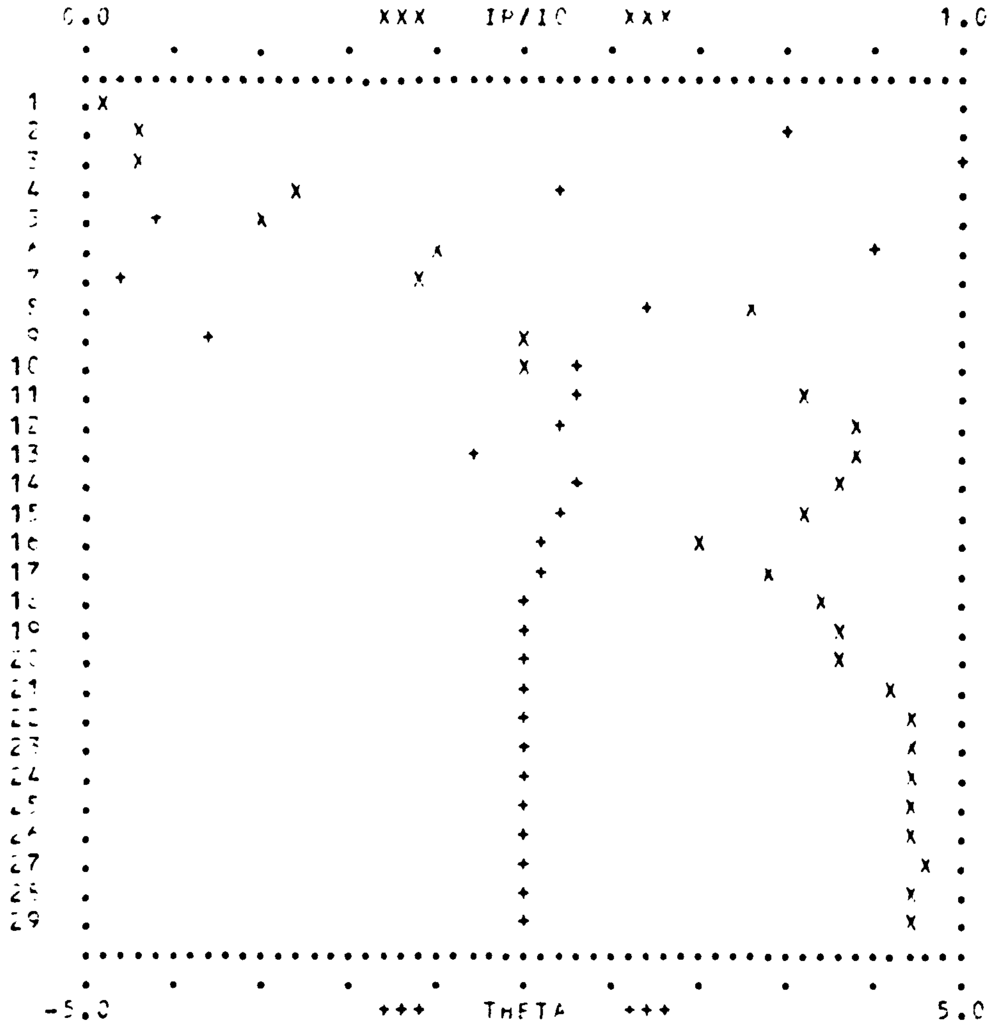
RUN 202. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



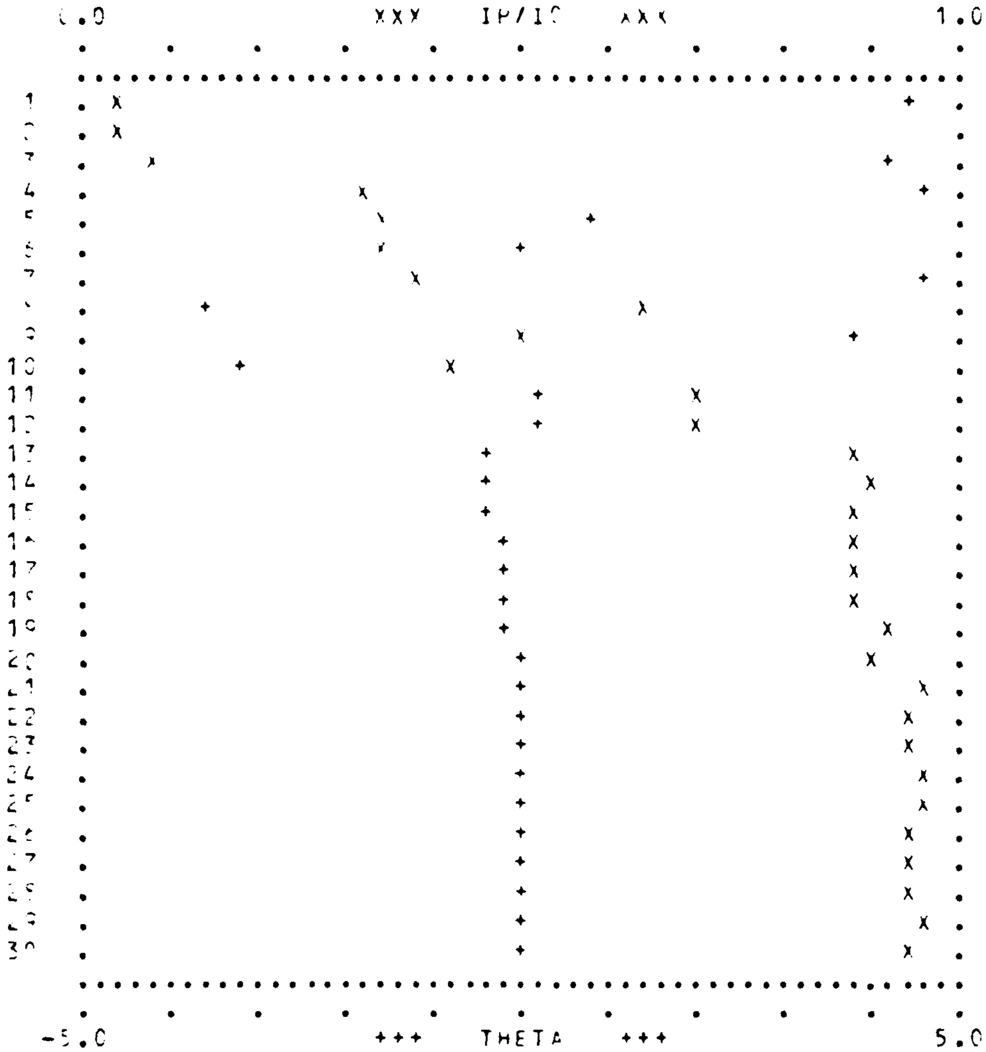

RUN 203. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



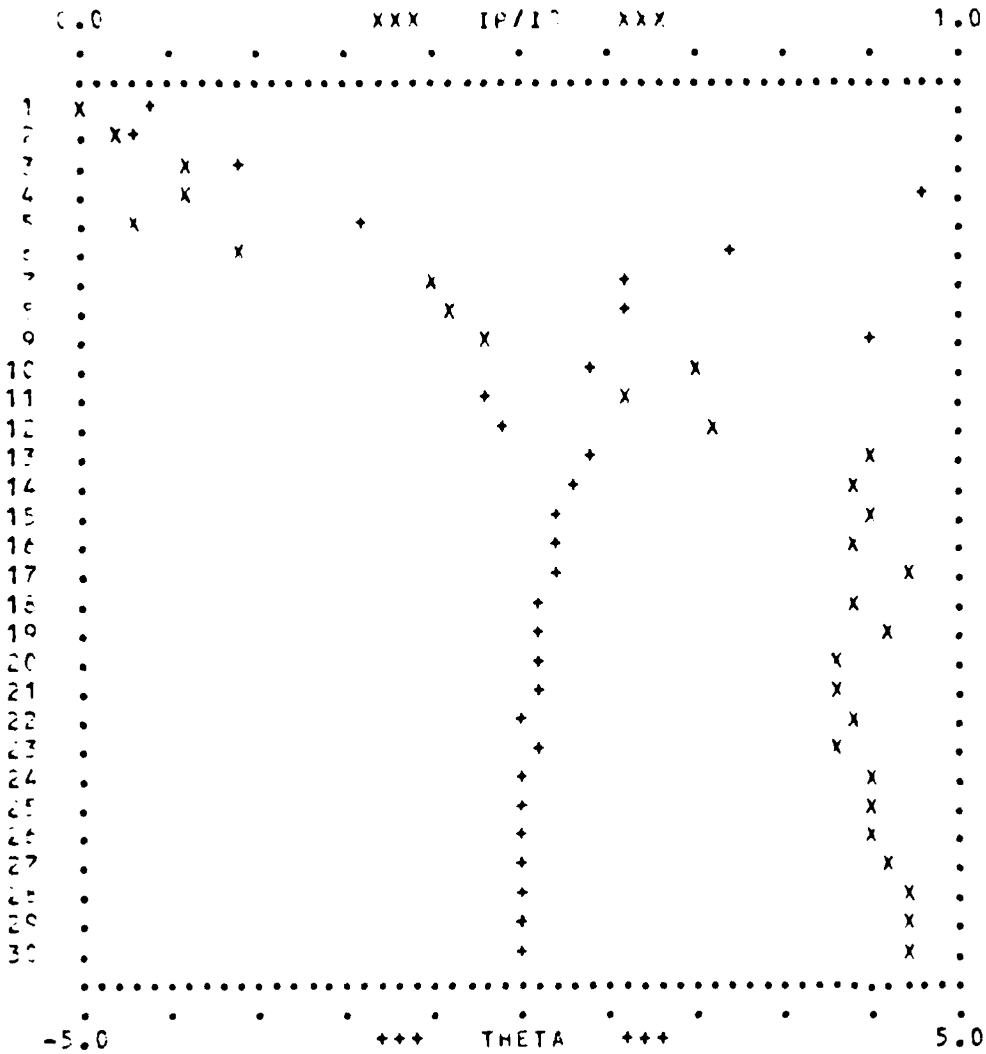

RUN 204. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.50000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



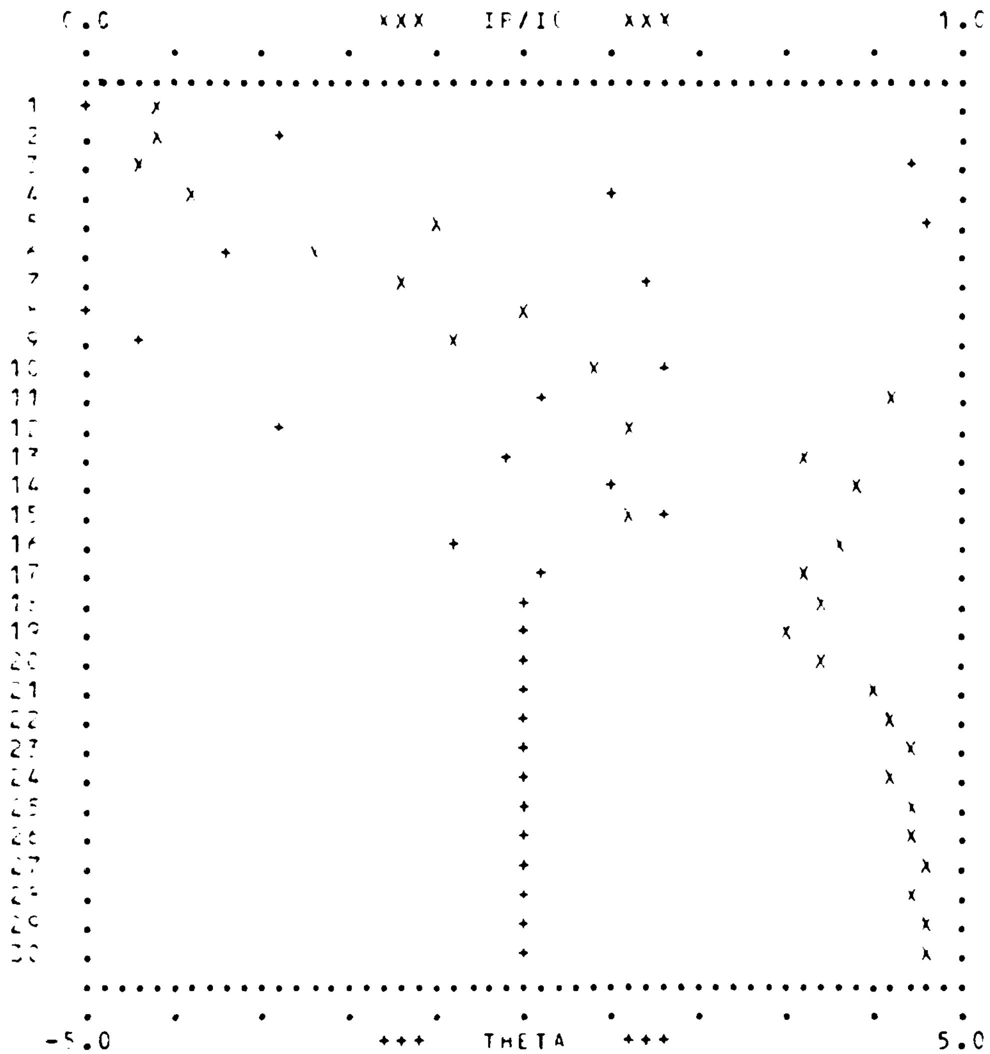
RUN 205. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



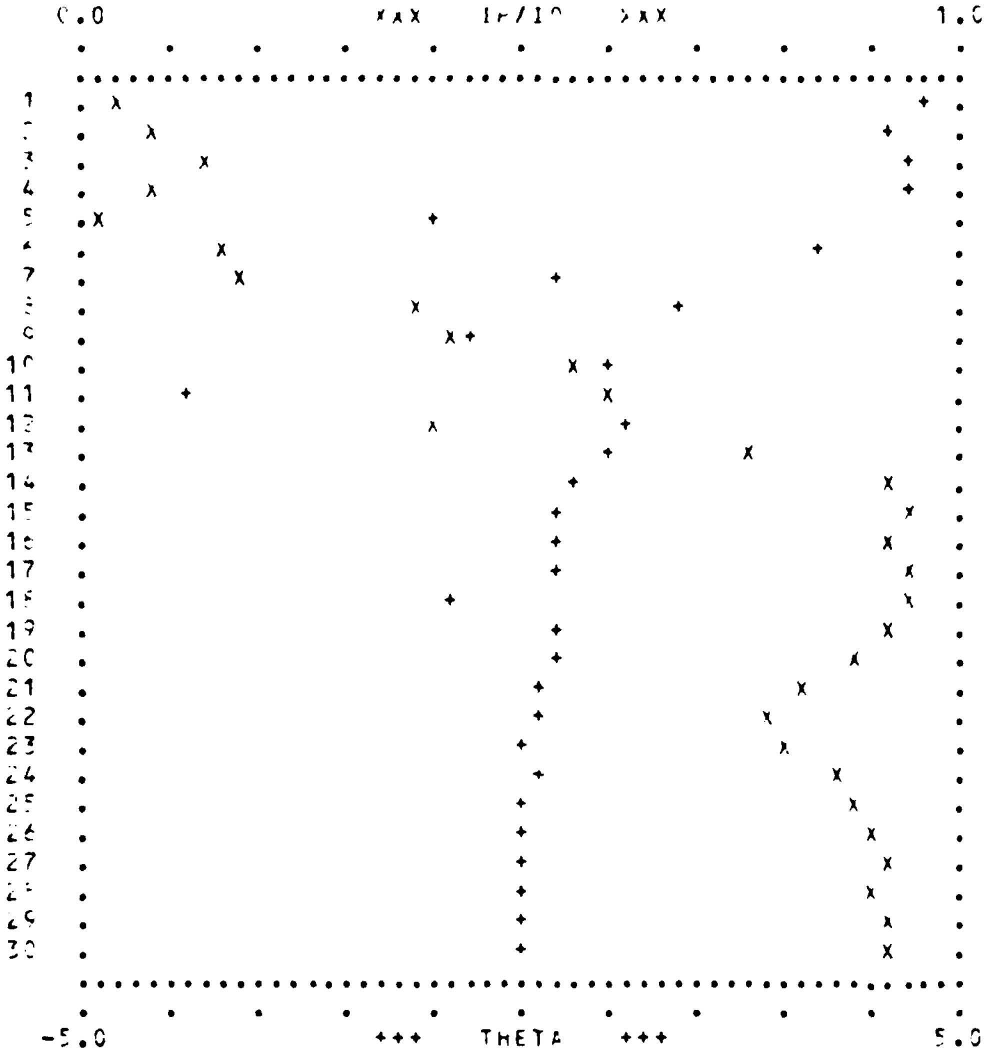

RUN 206. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



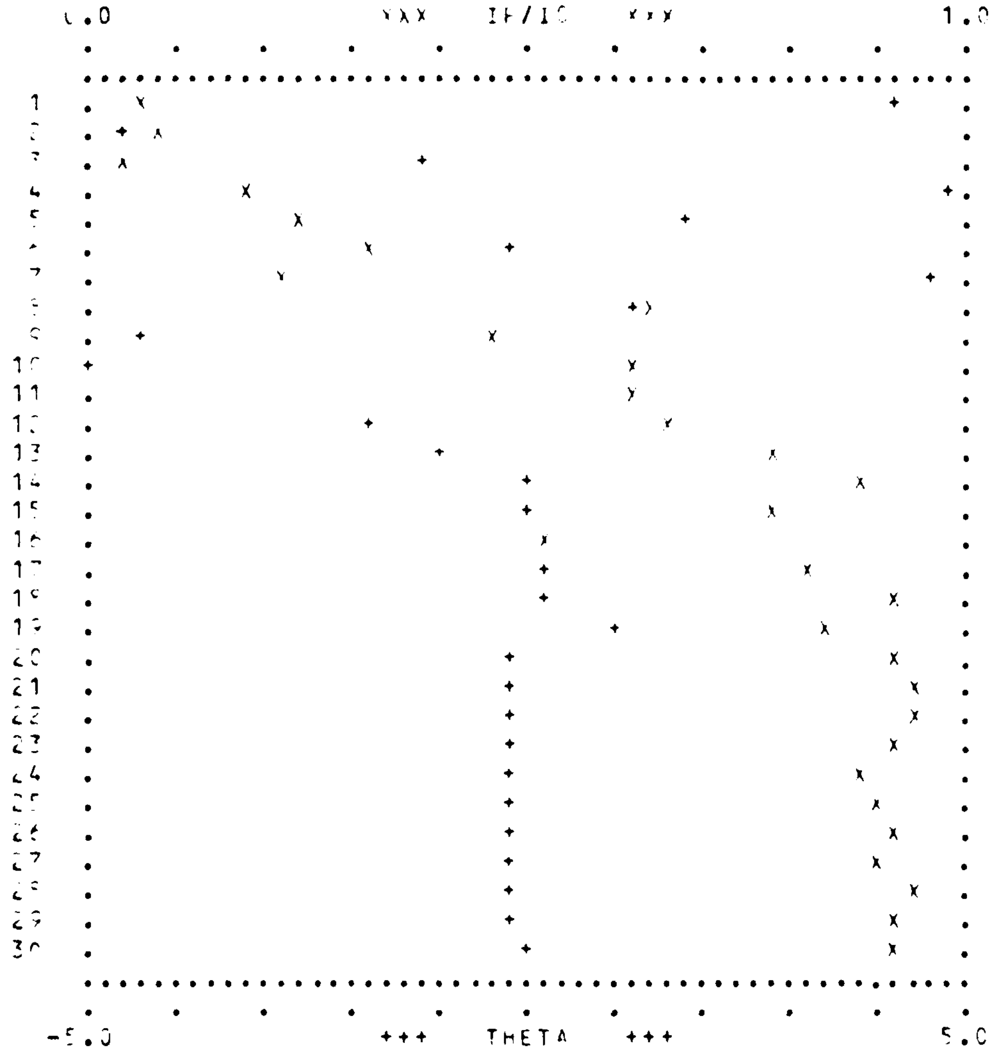

RUN 207. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



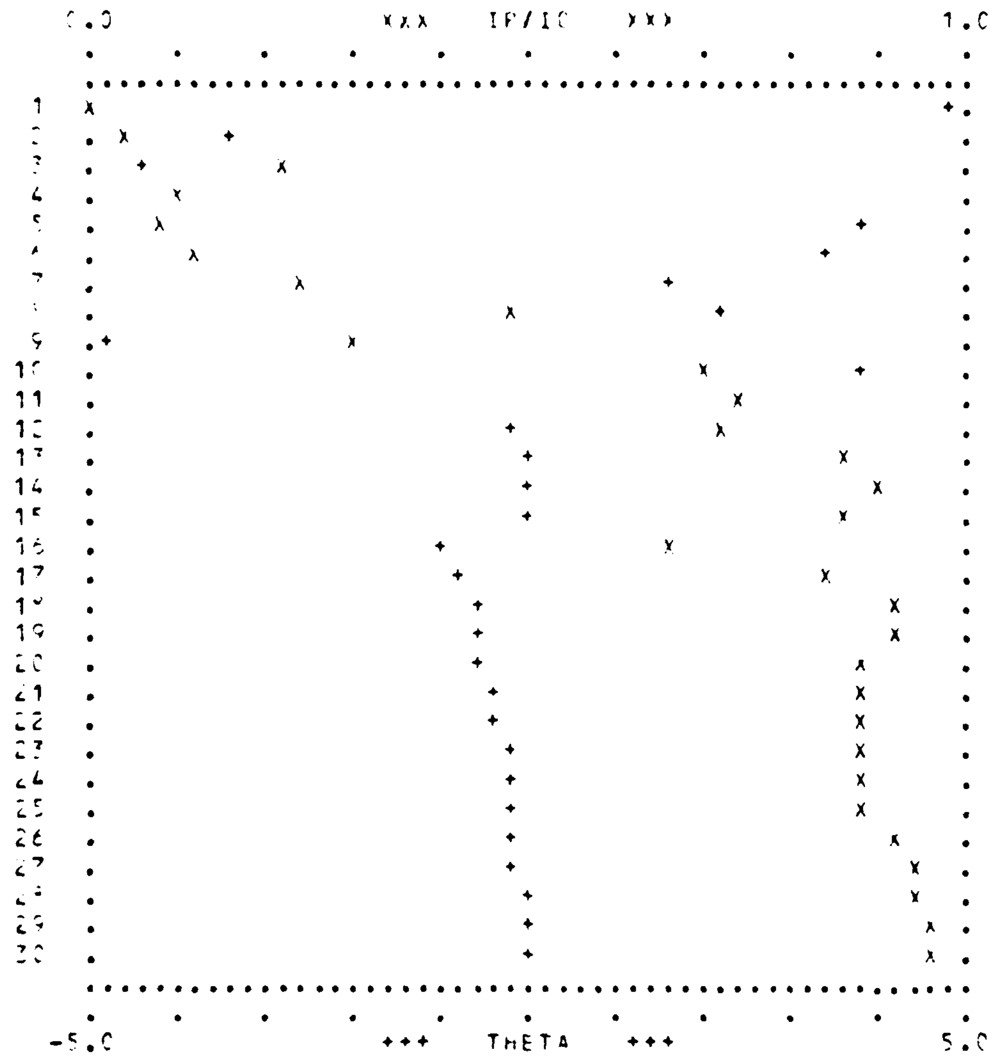

RUN 208. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



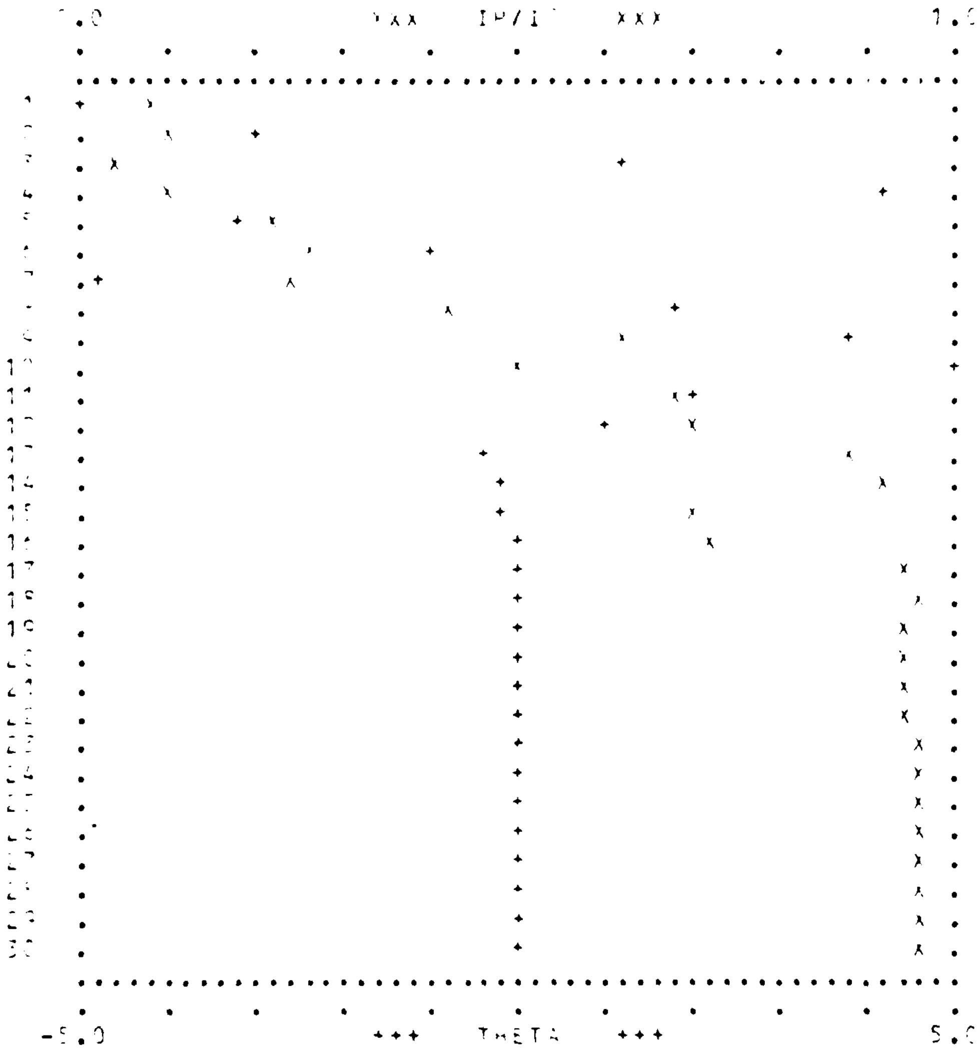

RUN 209. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



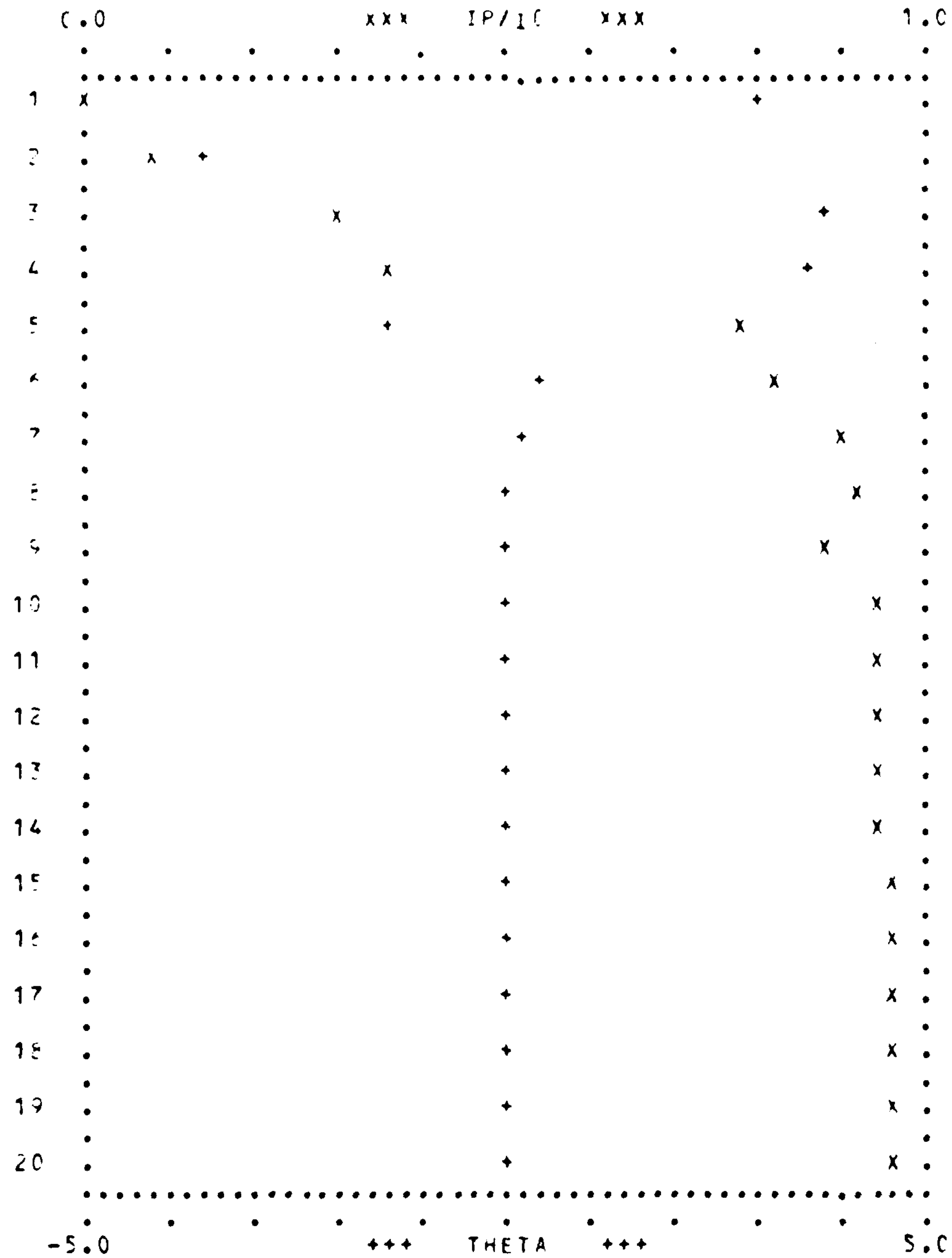

RUN 210. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



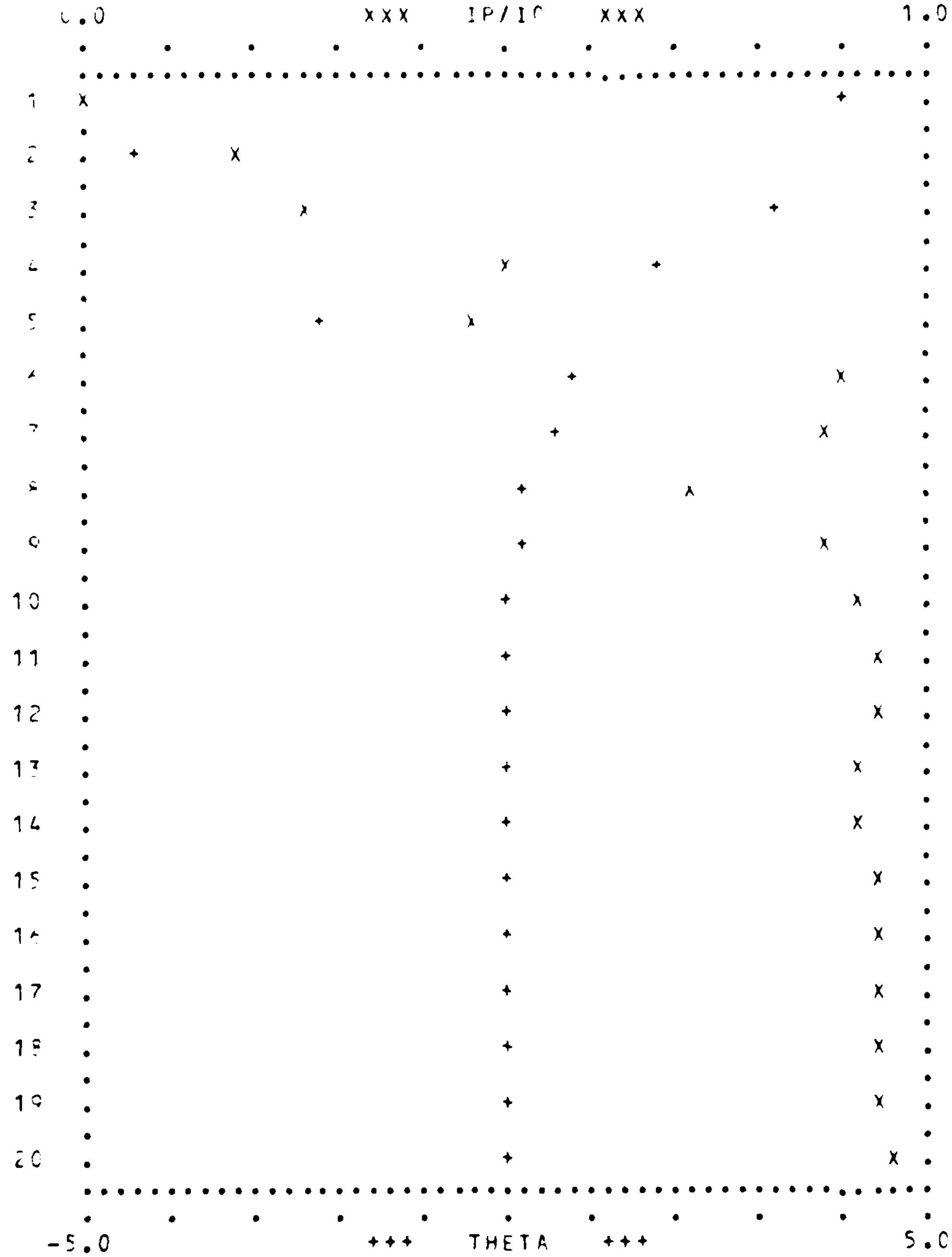

RUN 211. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



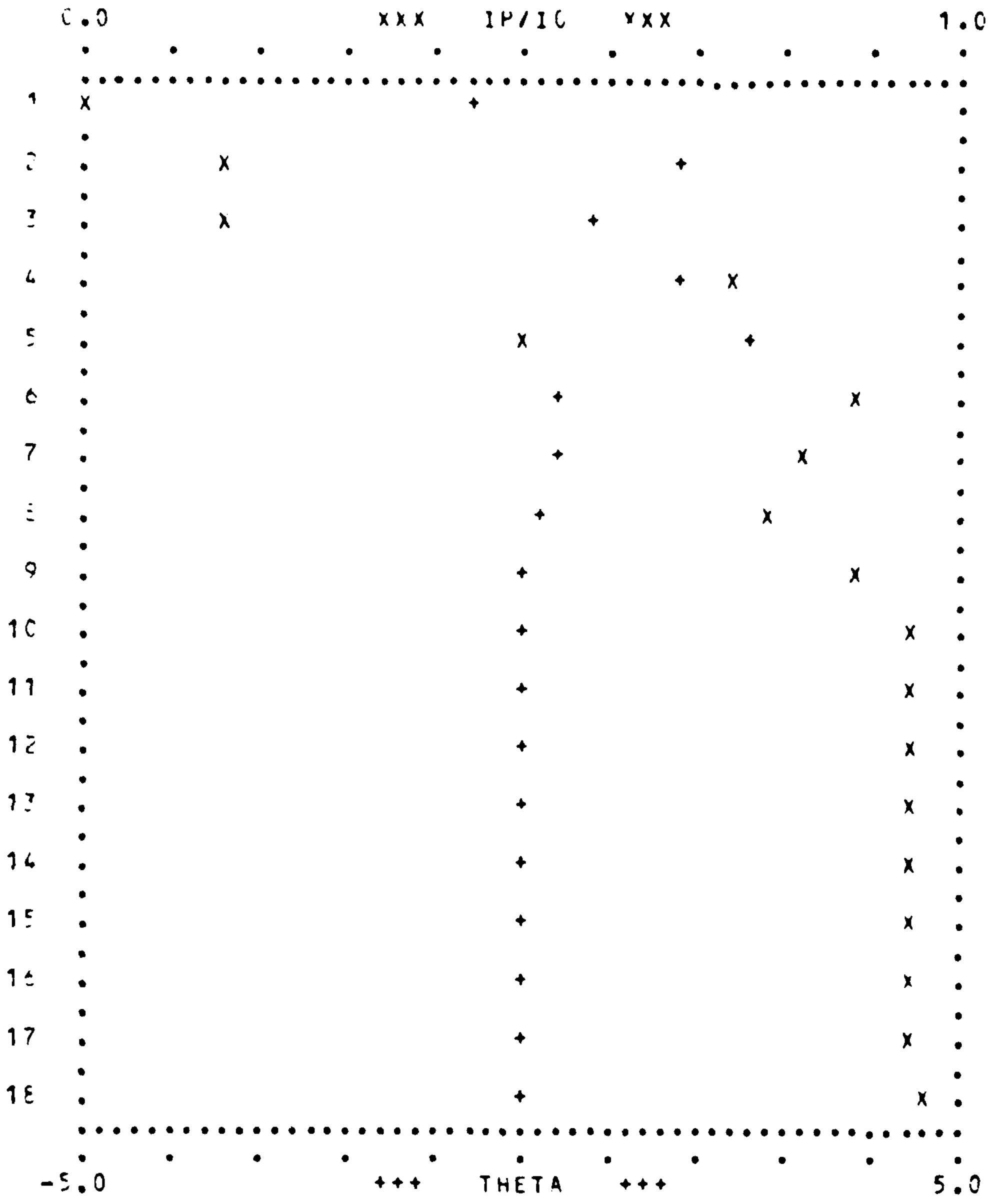

RUN 212. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 256.



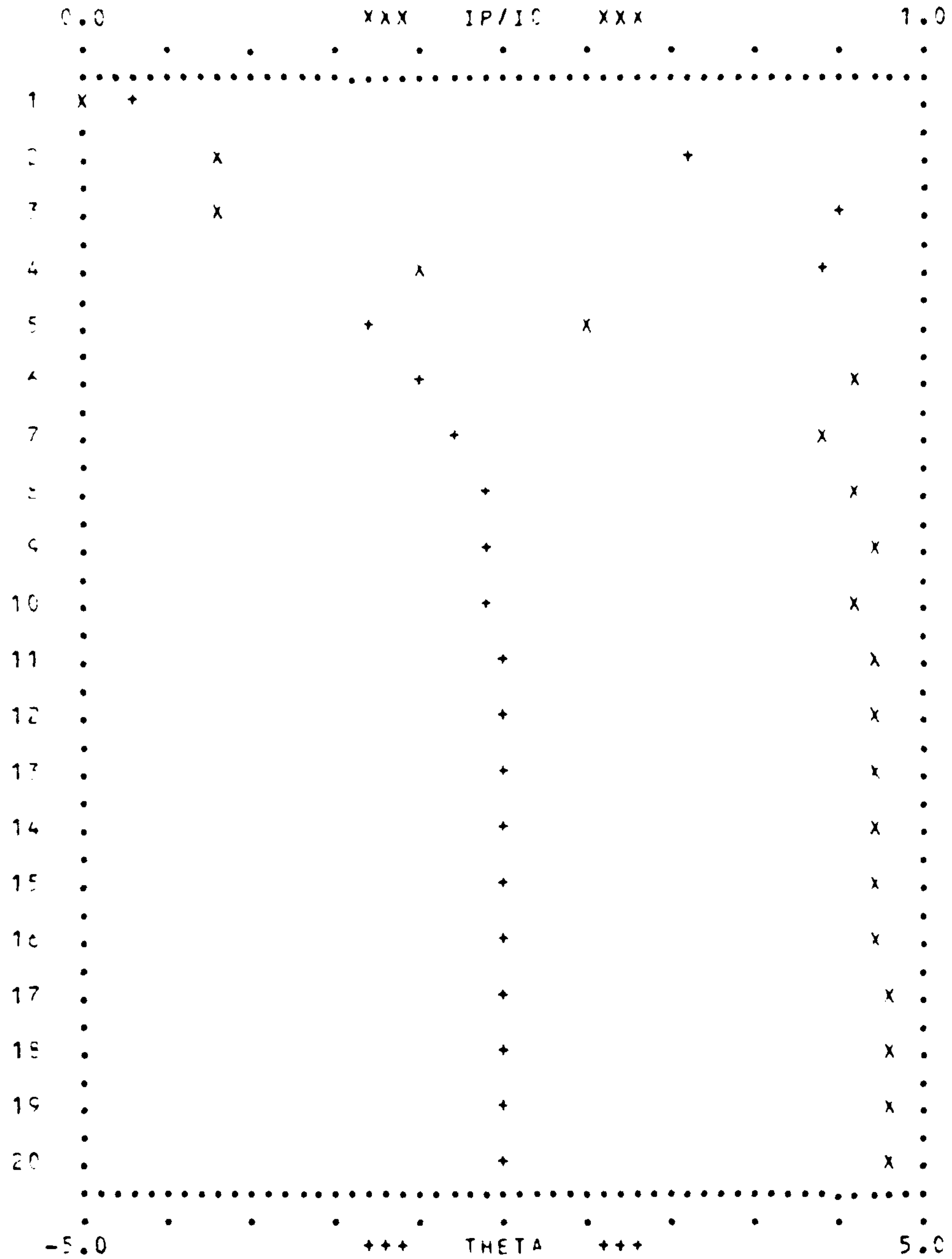

RUN 311. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/10, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



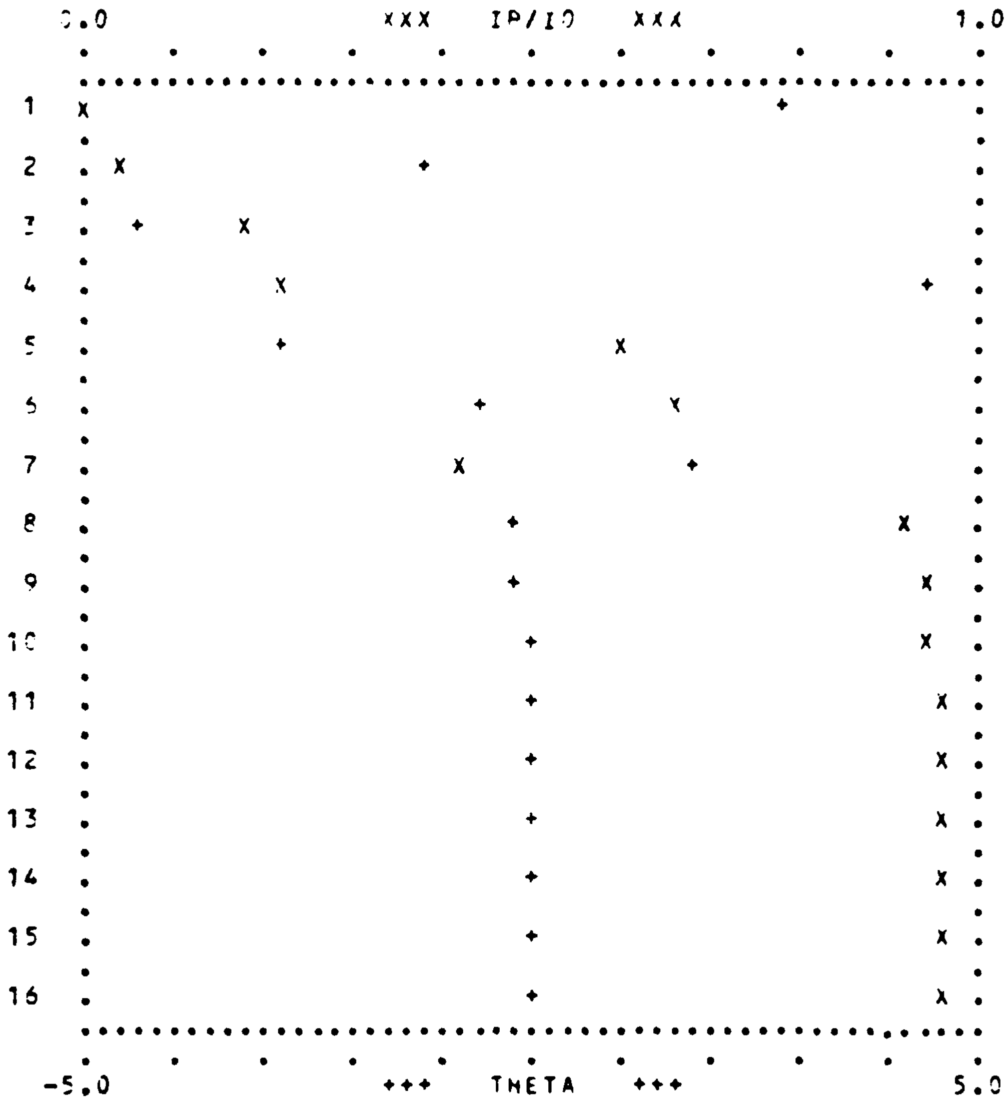

RUN 312. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



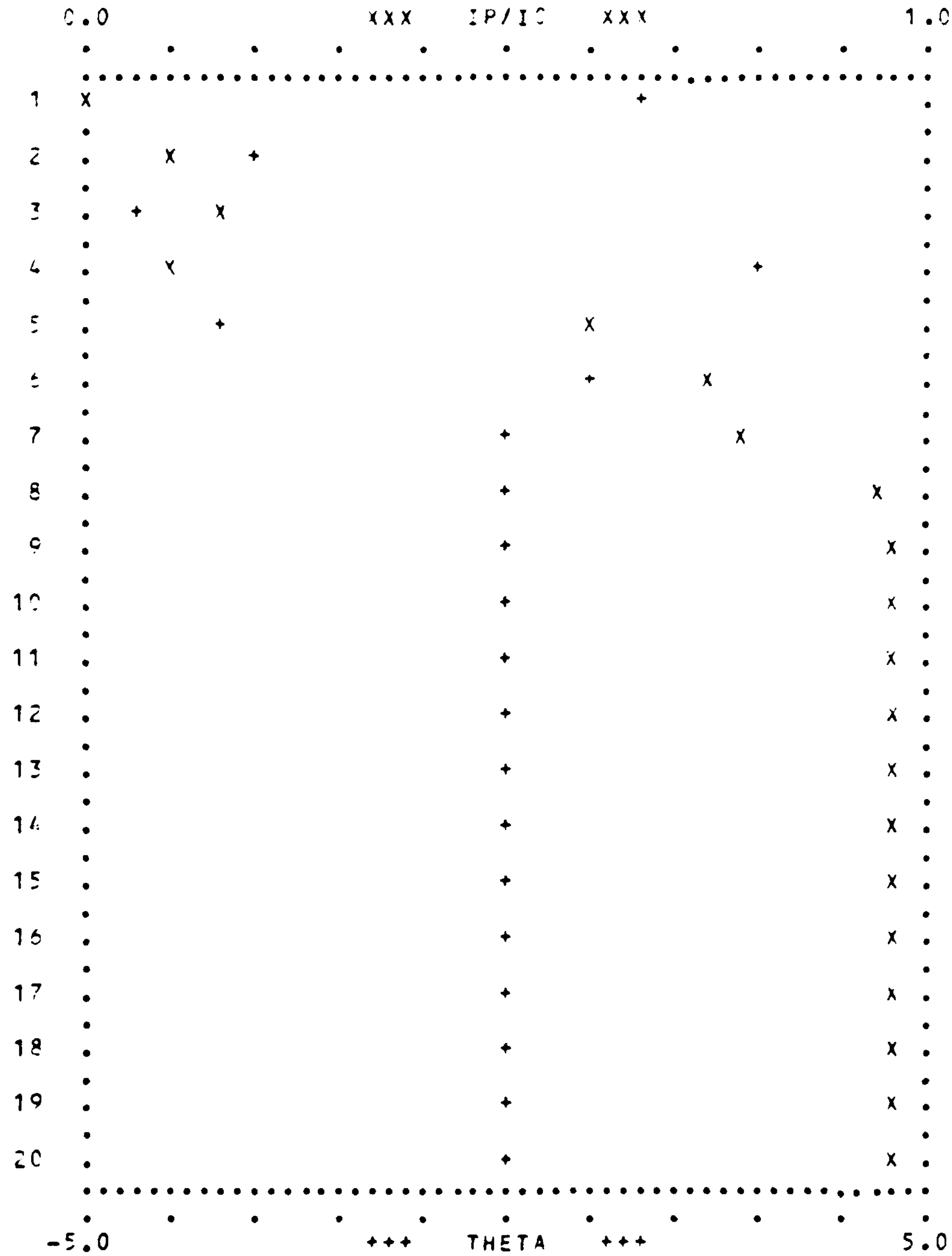

RUN 313. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



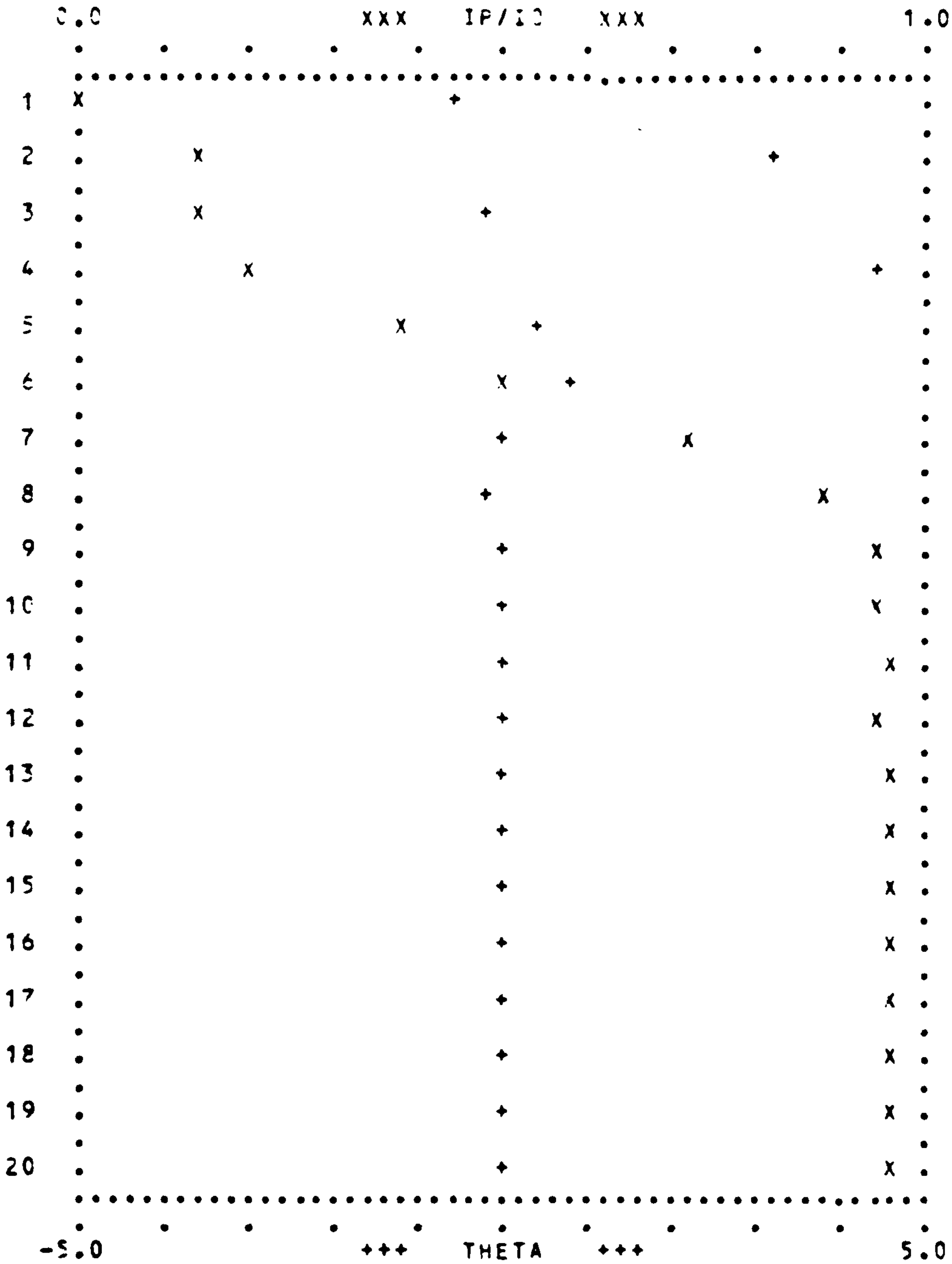

RUN 314. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



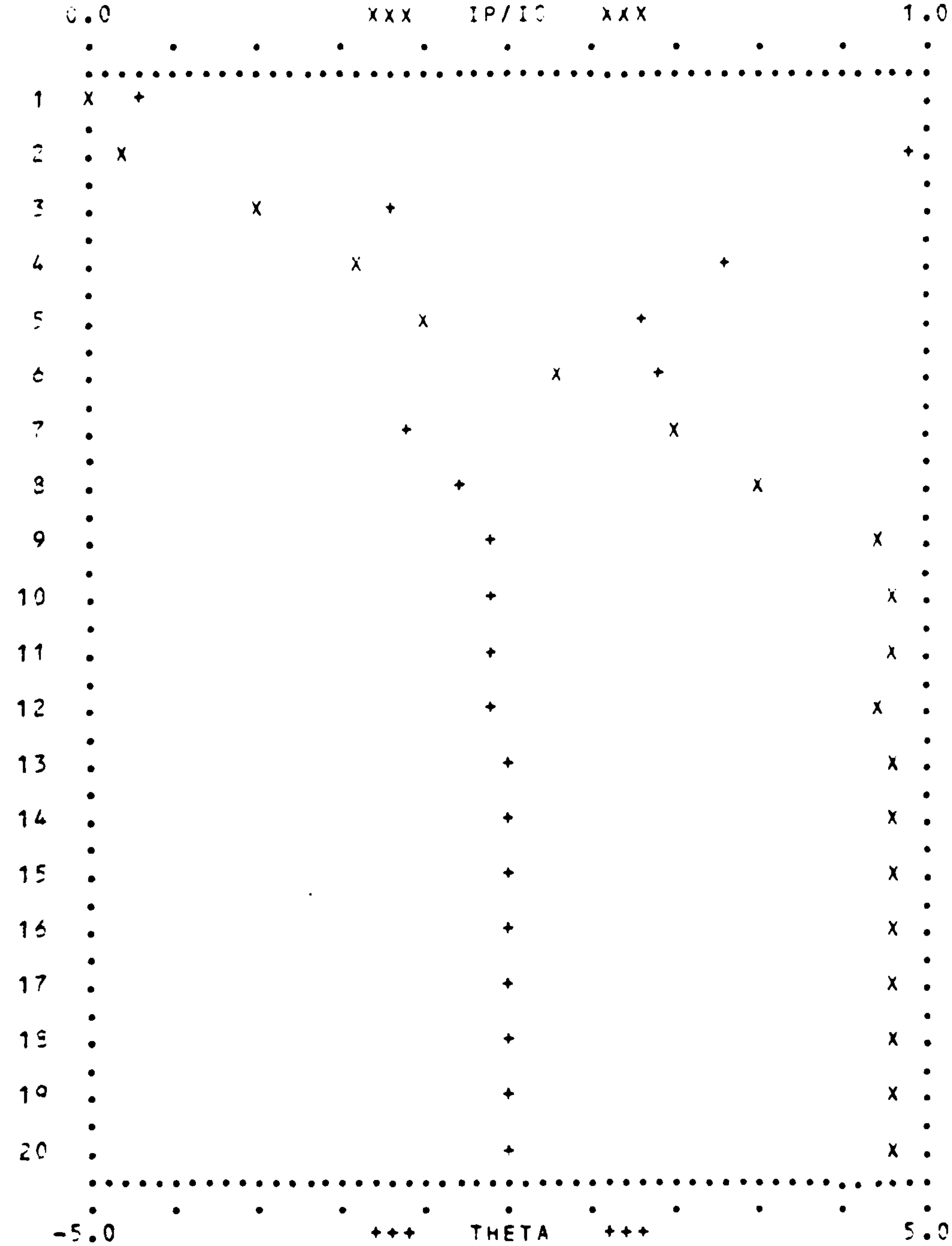

RUN 315. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



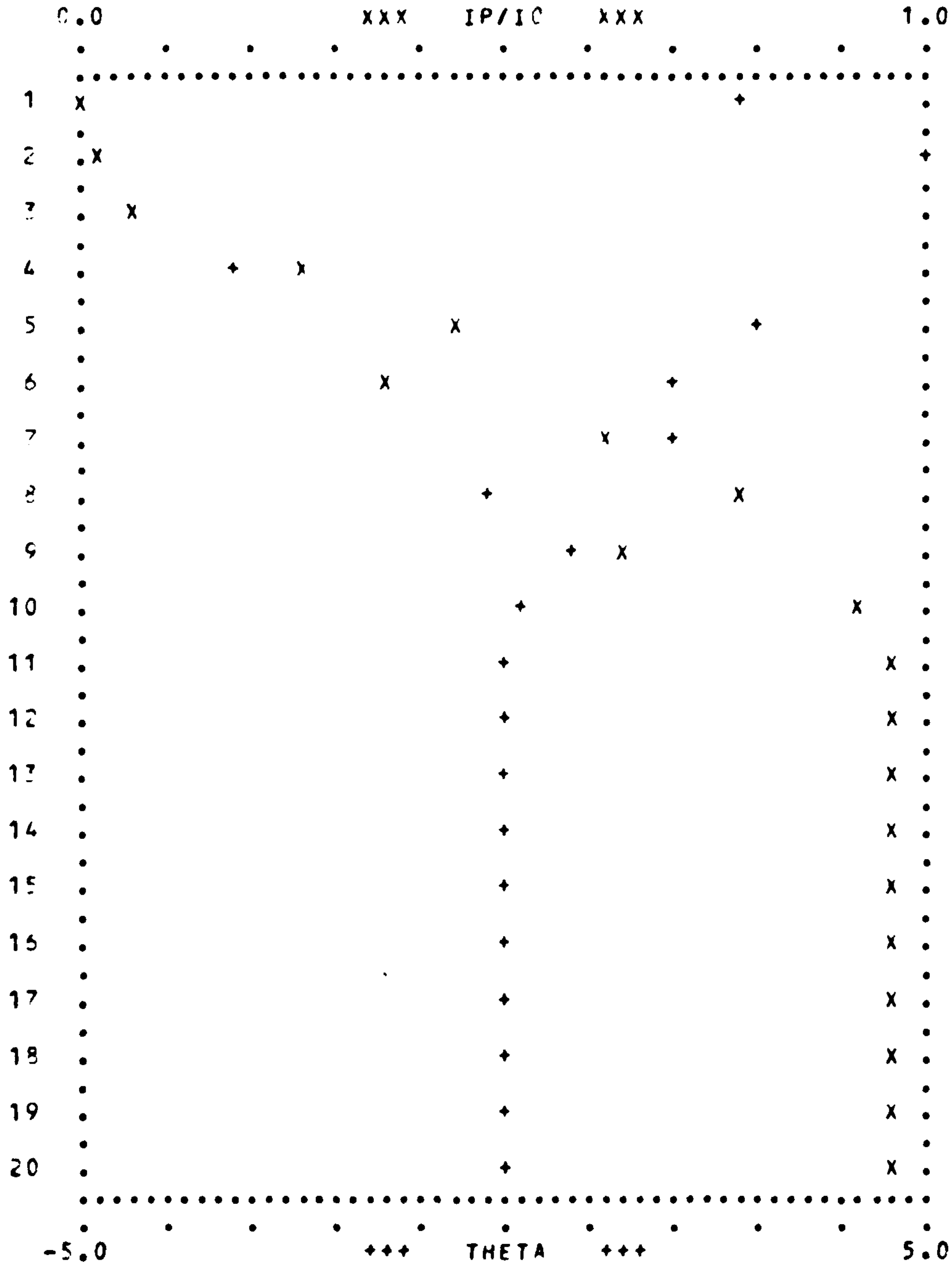

RUN 316. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



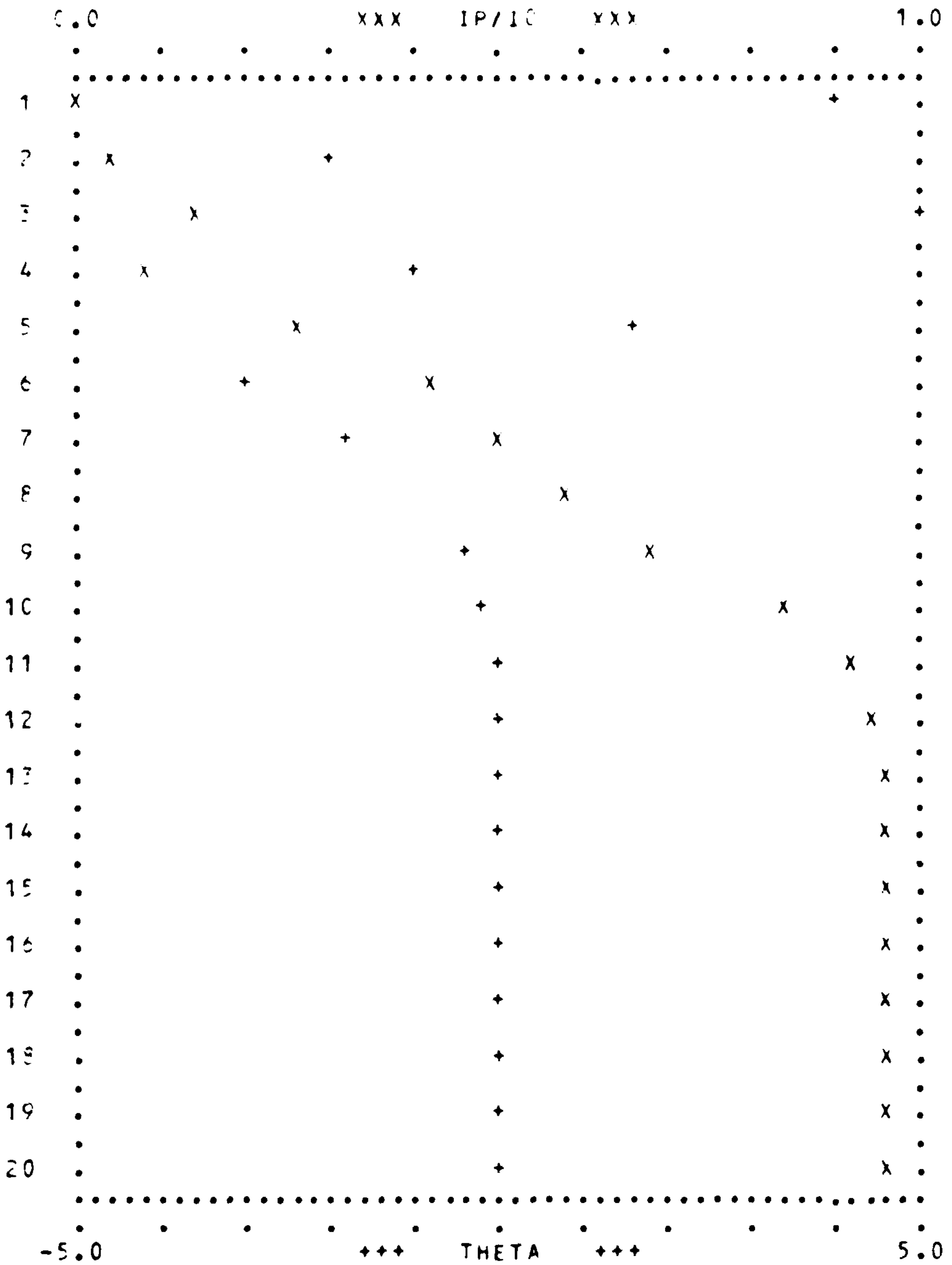

RUN 317. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00000 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



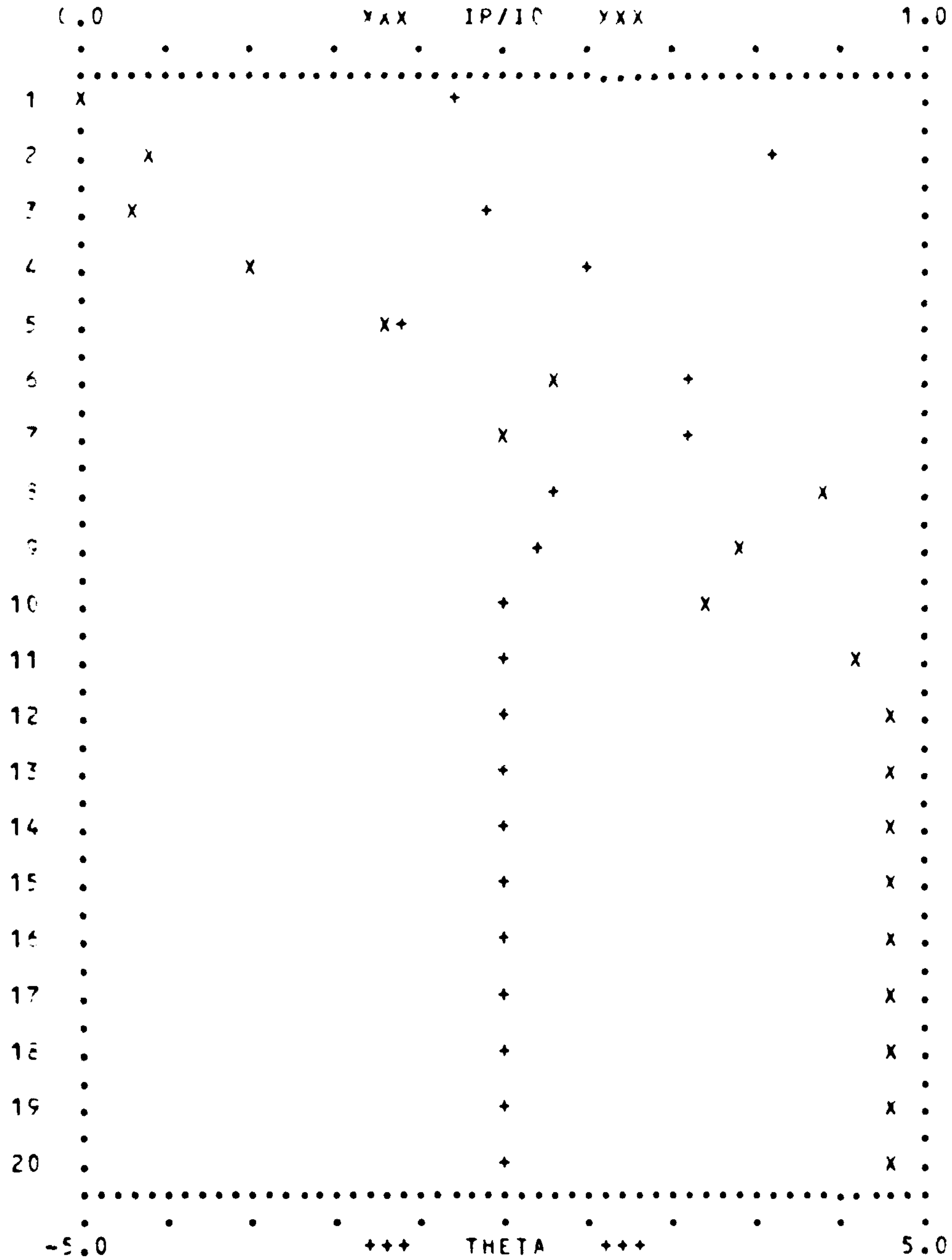

RUN 318. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



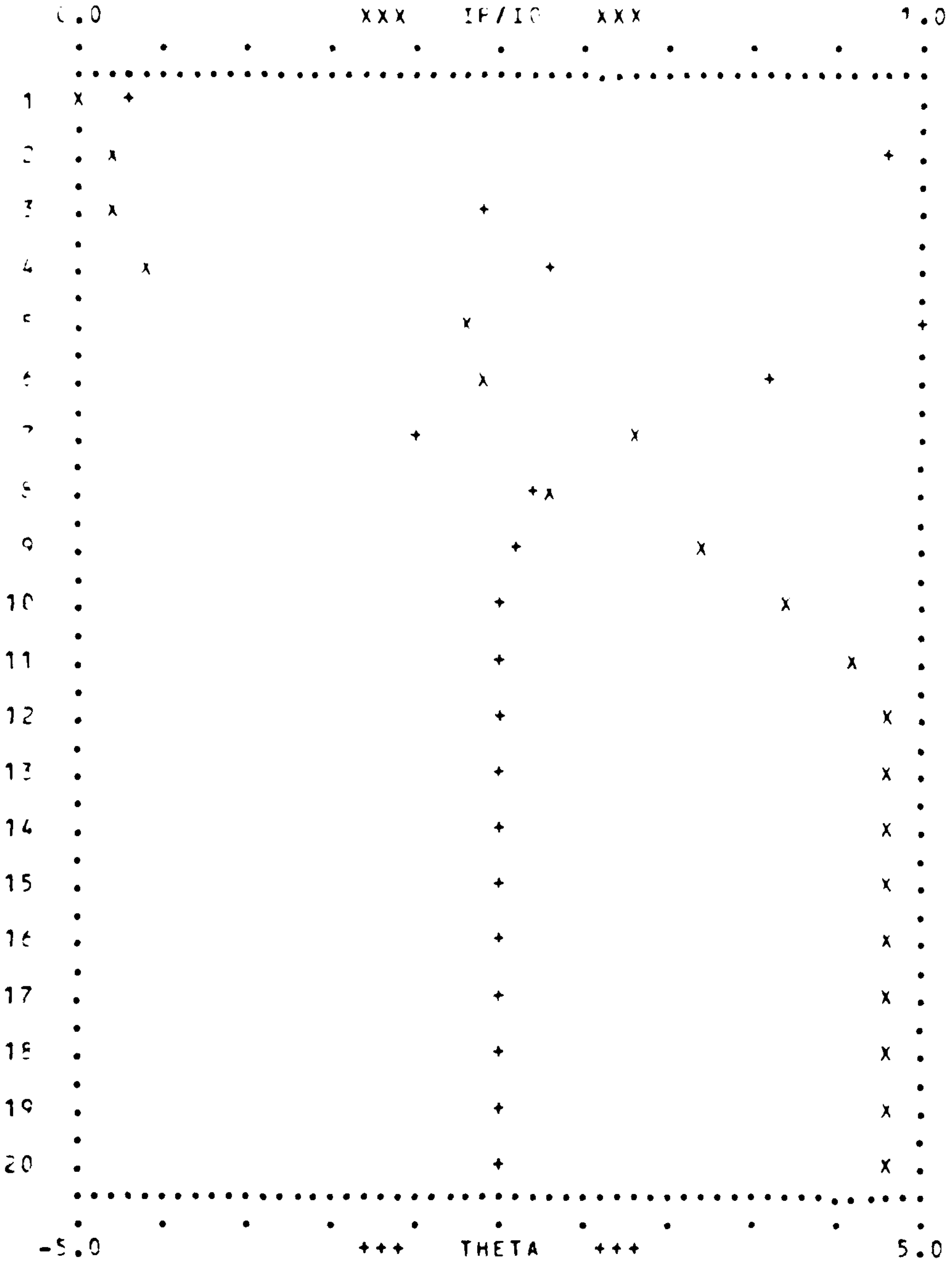

RUN 319. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



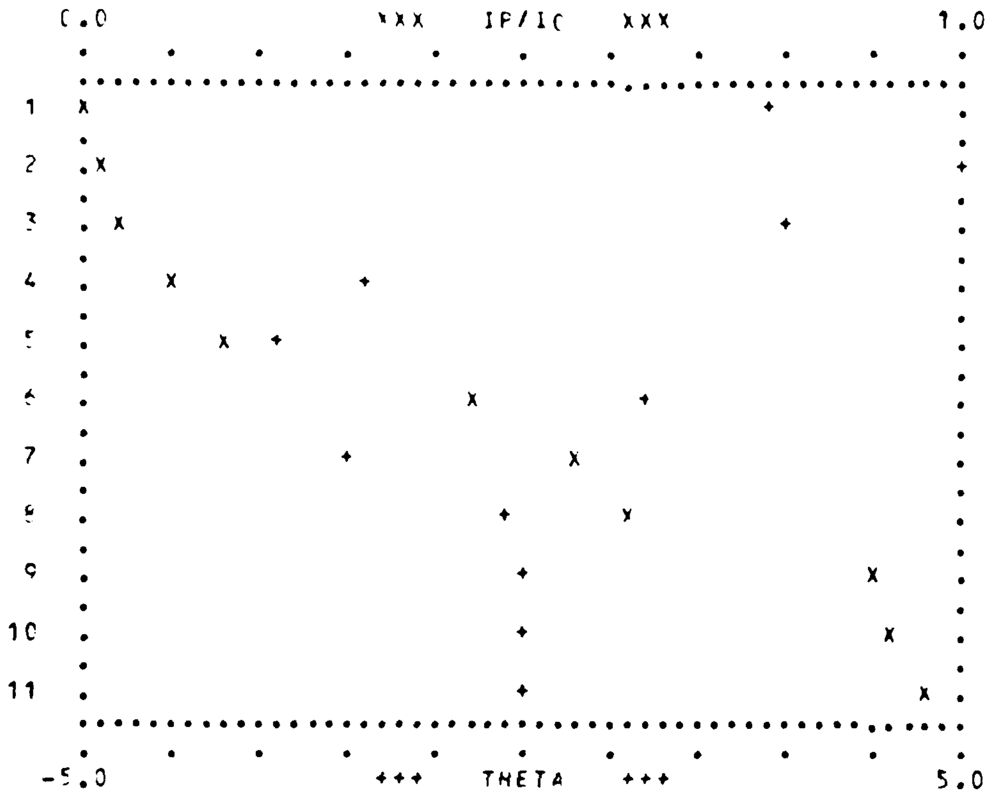

RUN 320. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



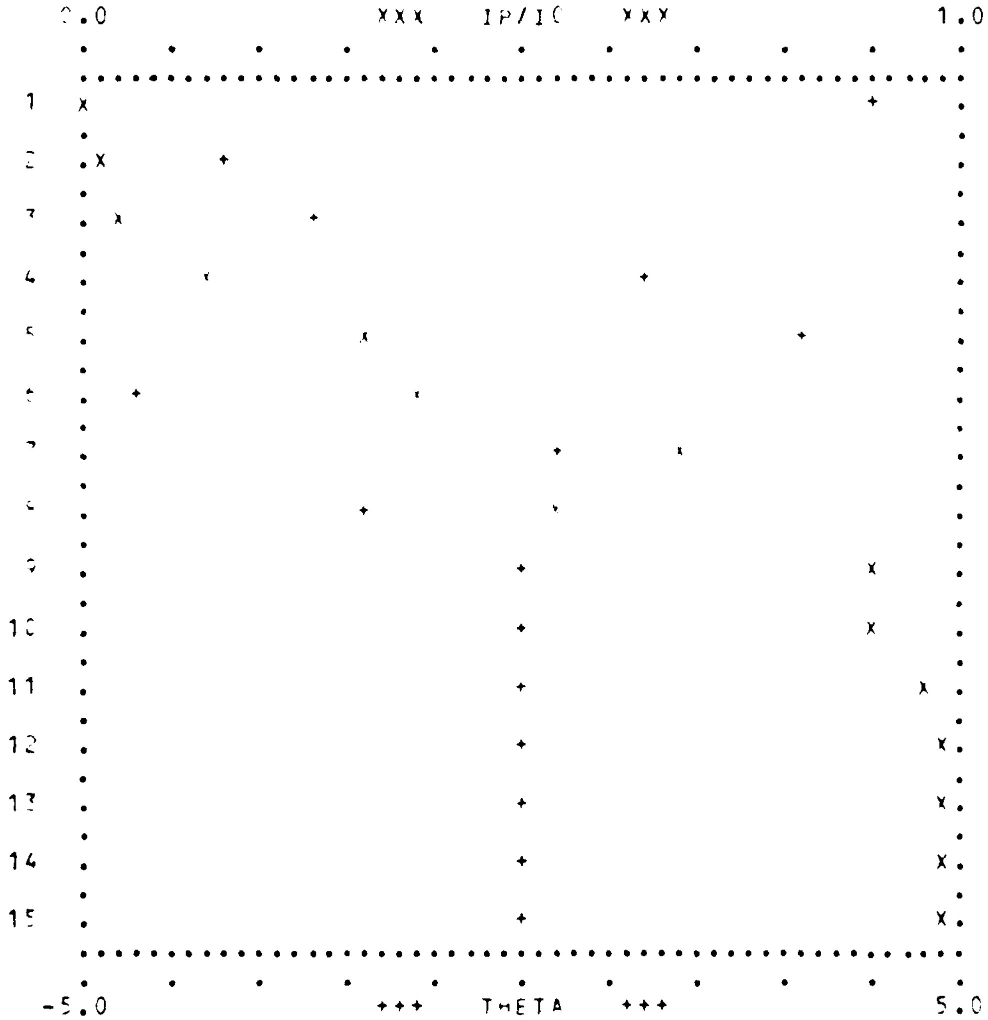

RUN 321. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



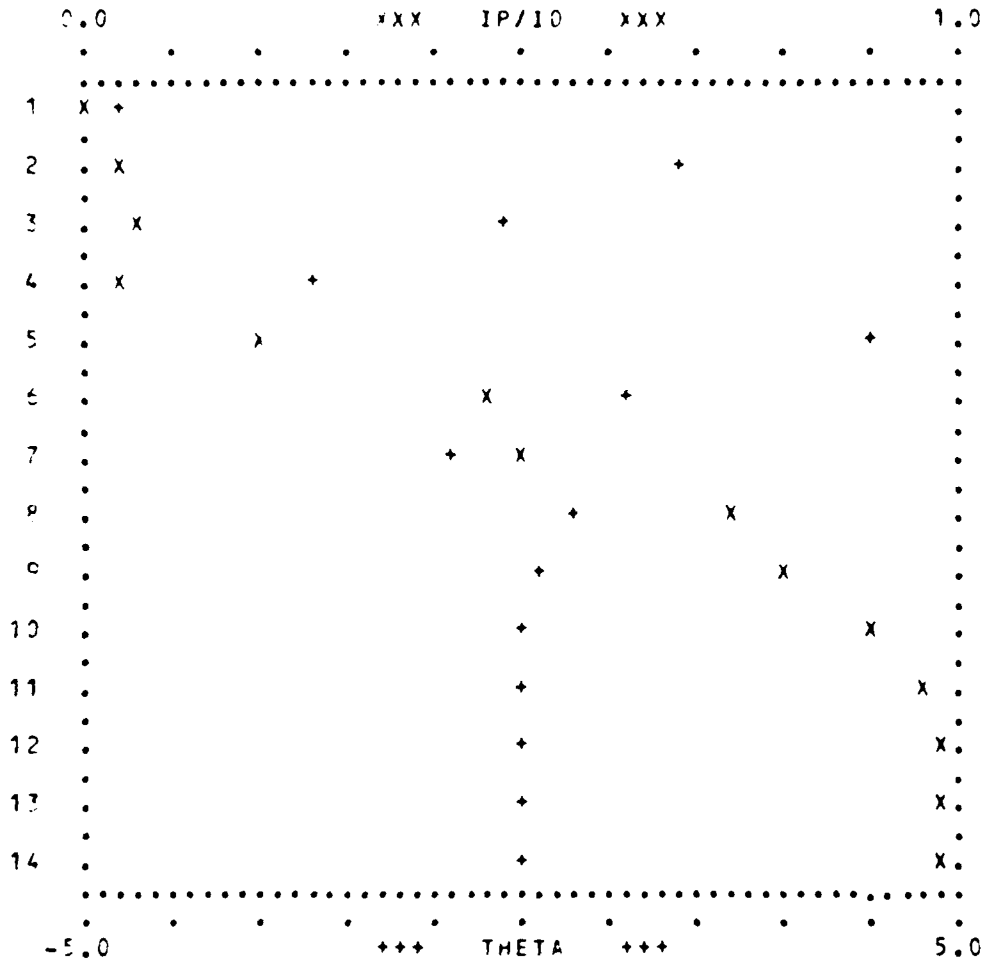

RUN 322. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



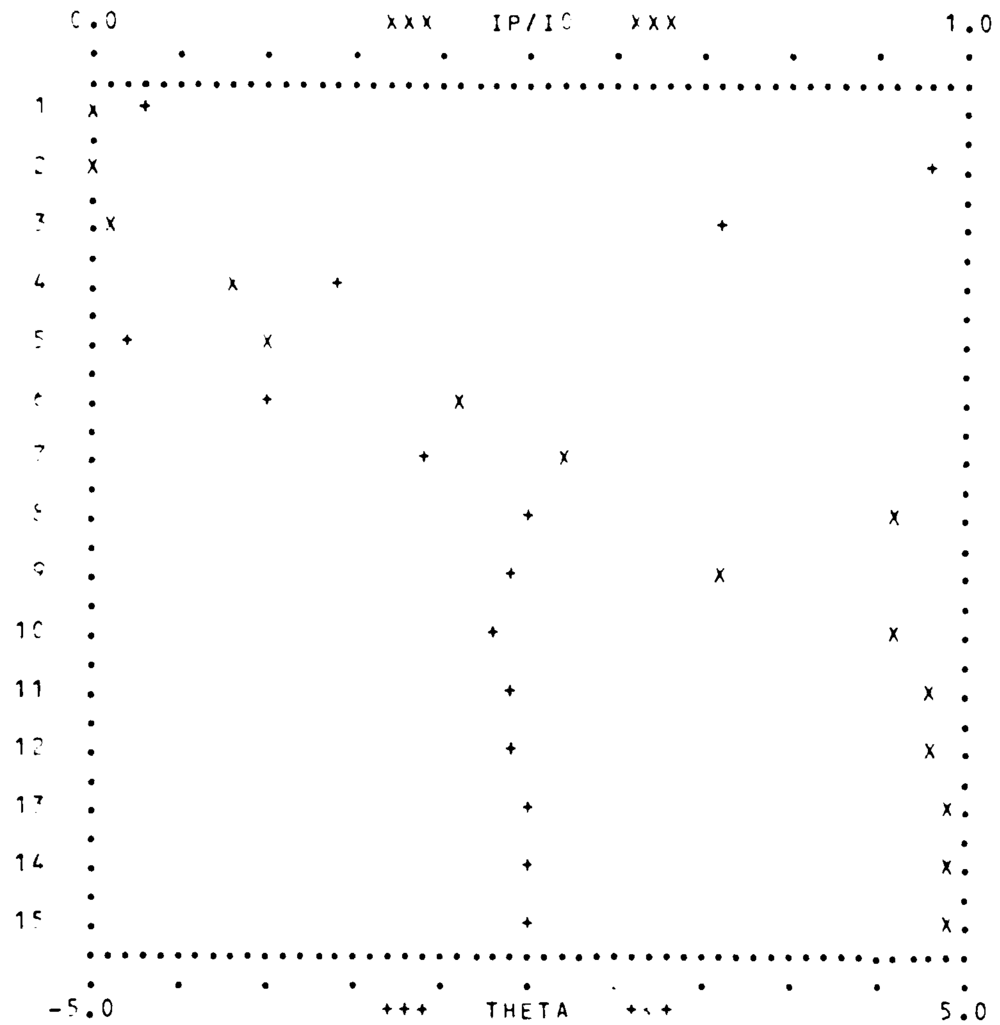

RUN 322. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



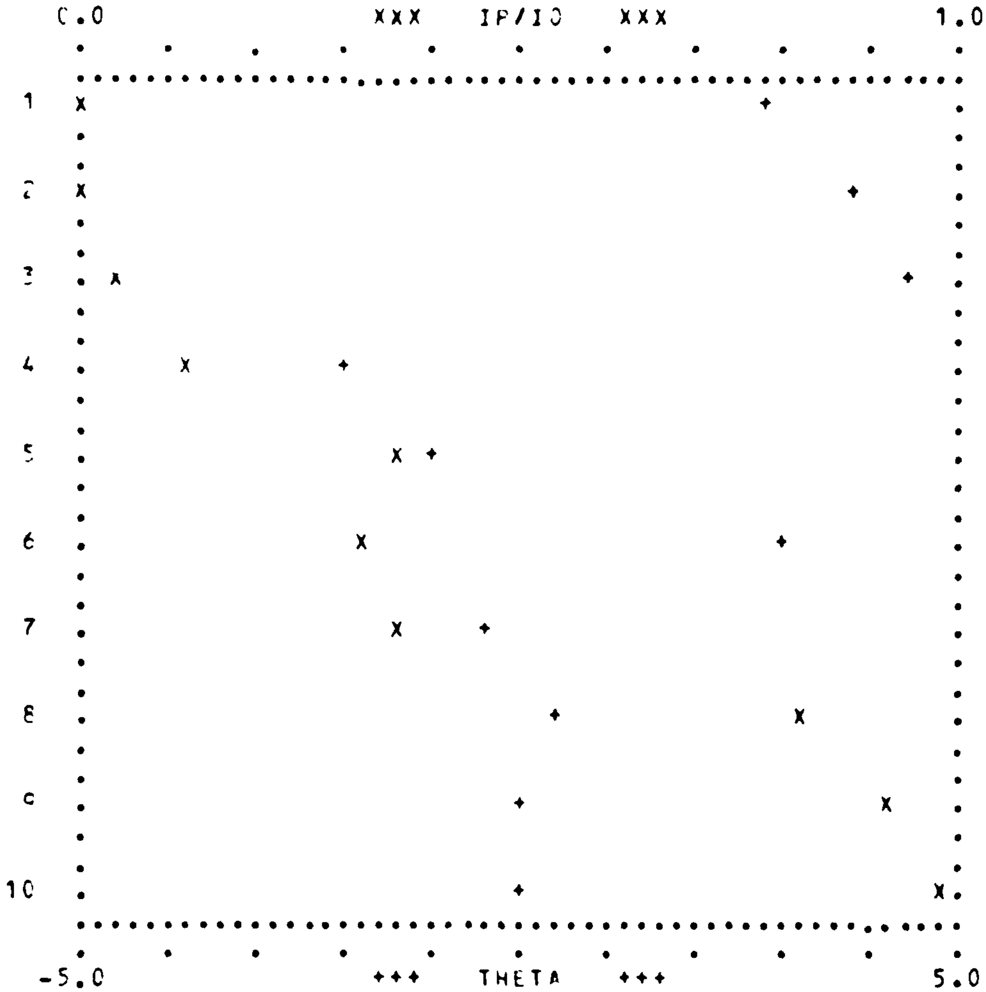

RUN 324. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



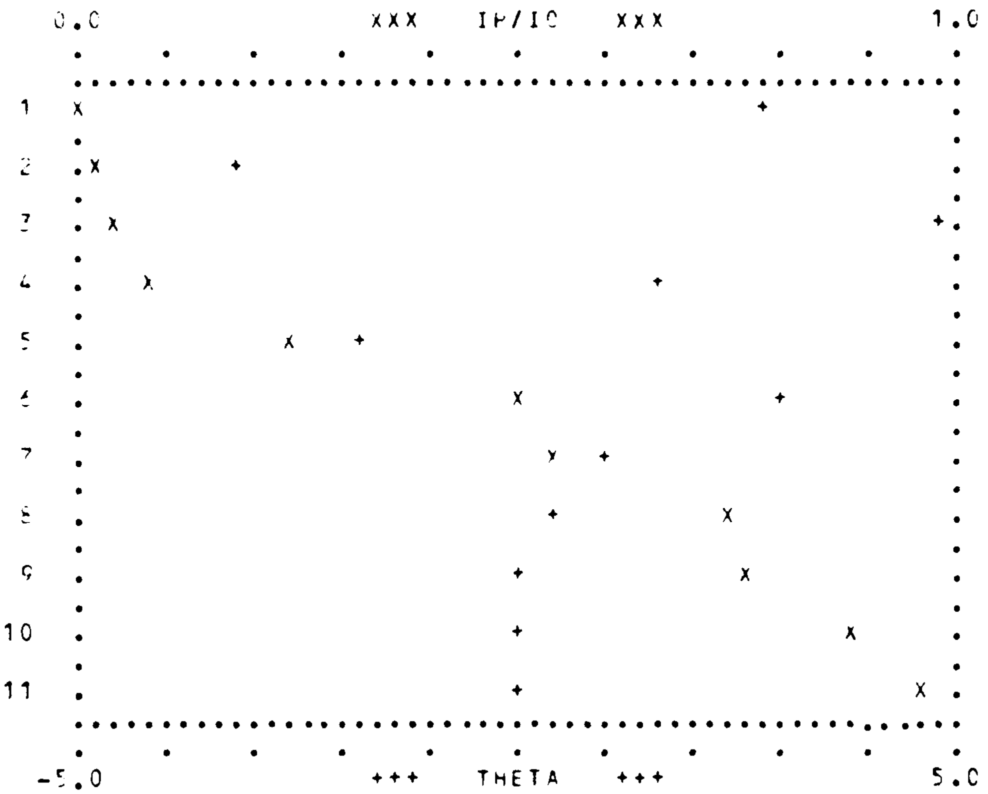

RUN 325. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.




RUN 326. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.




RUN 327. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.




RUN 328. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.30000;MAGNIFICATION=2.00003
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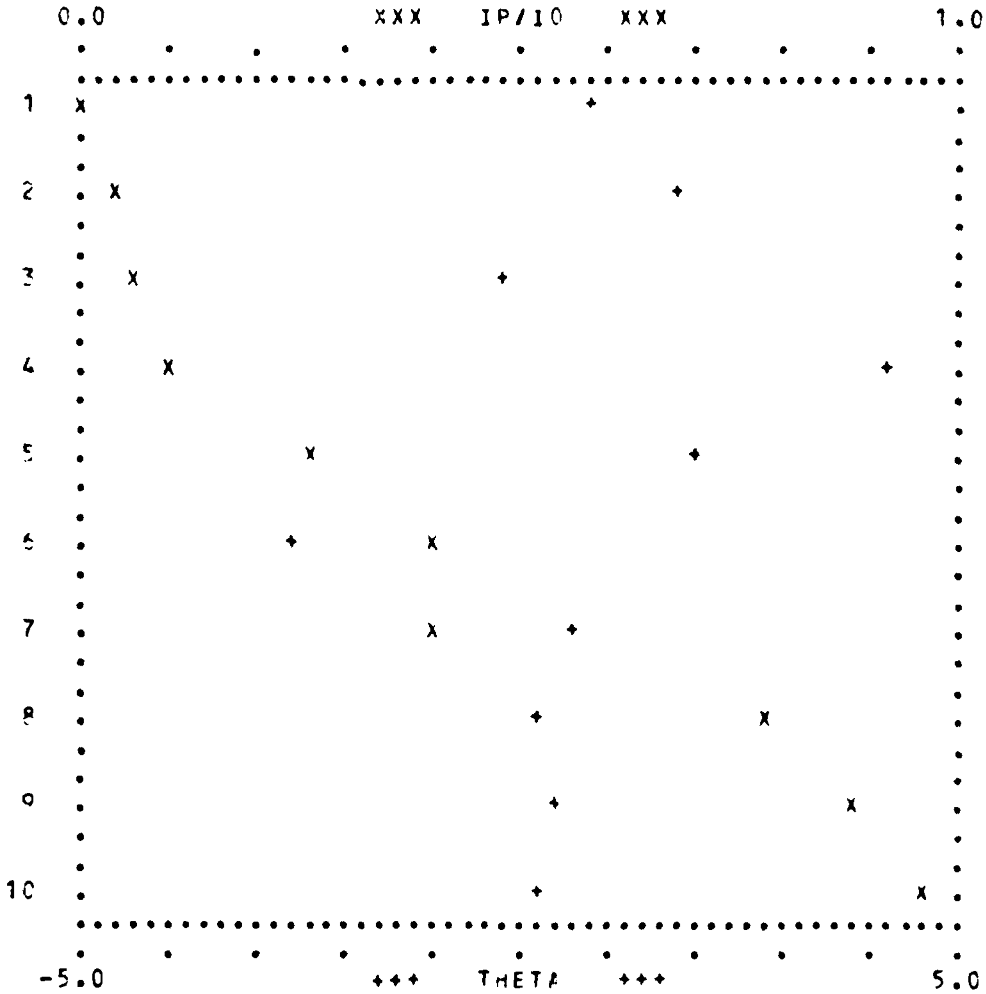
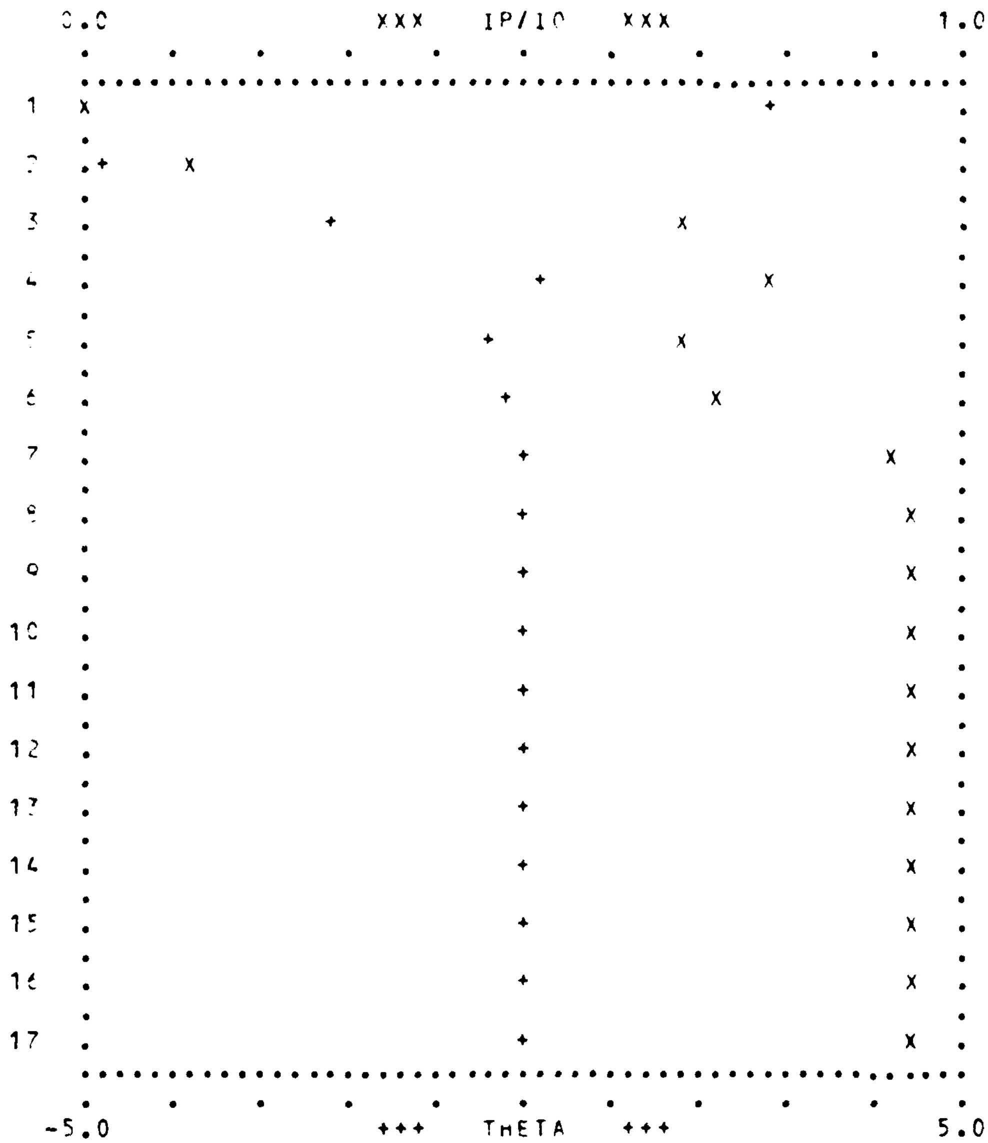
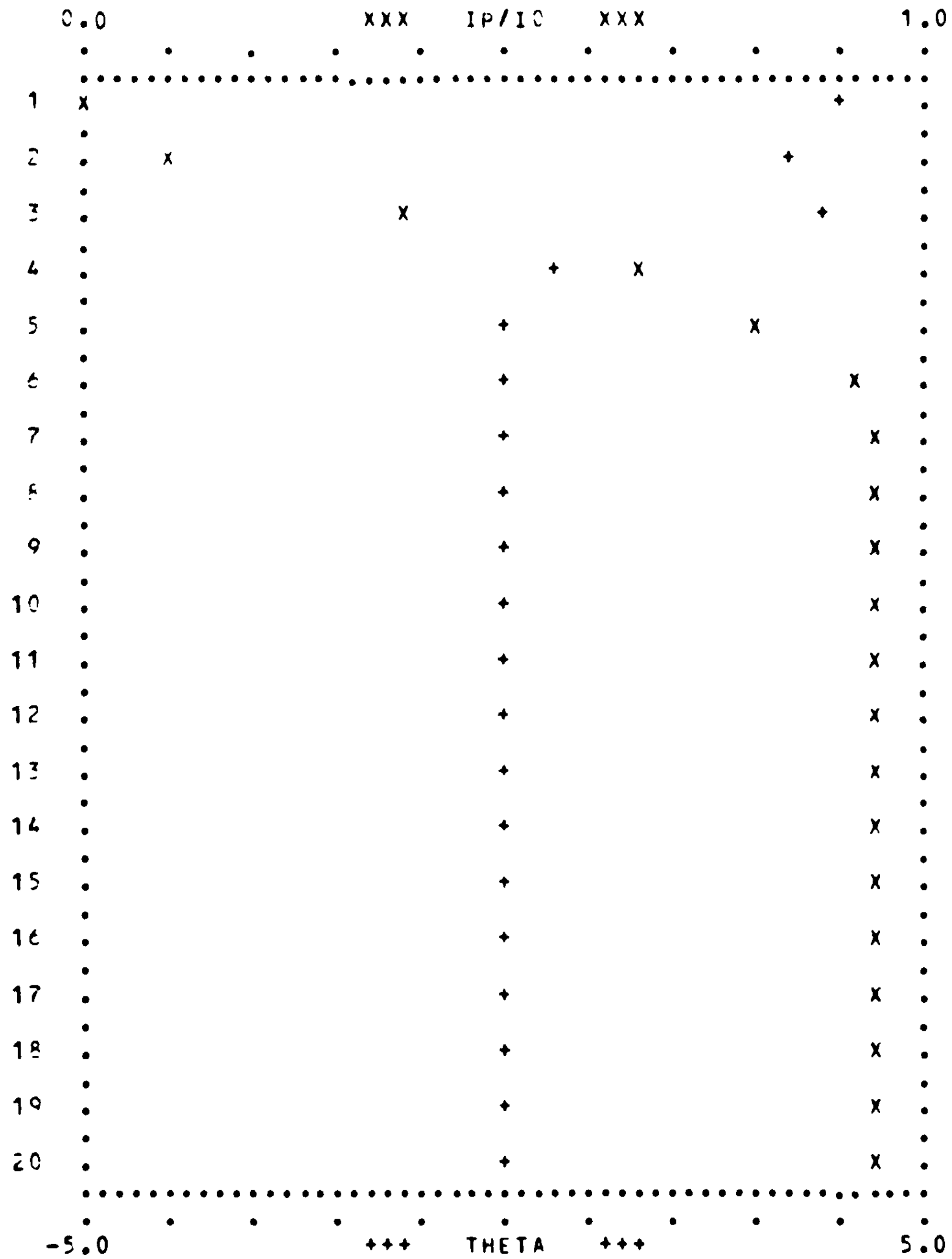


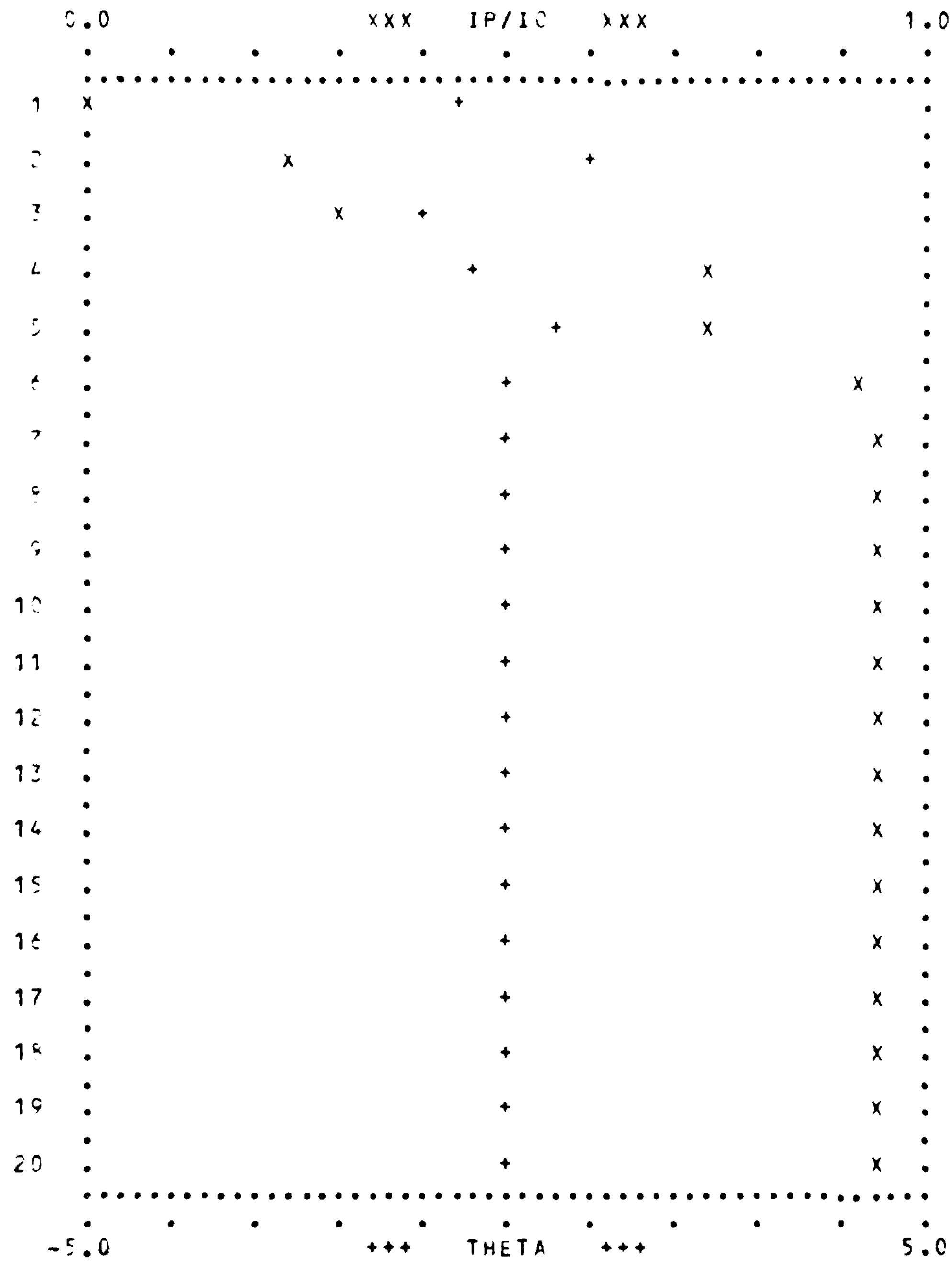

RUN 329. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



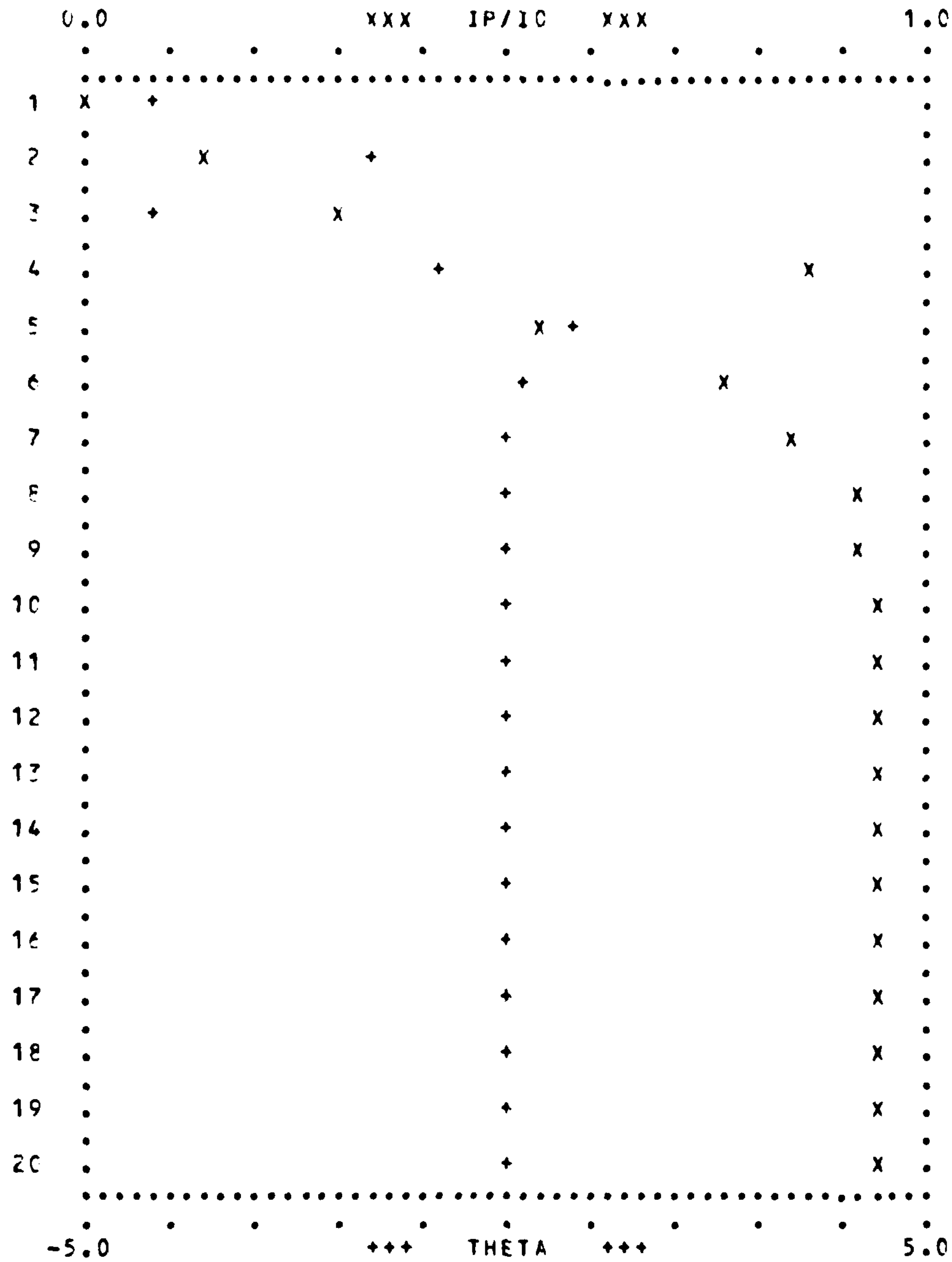

RUN 331. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



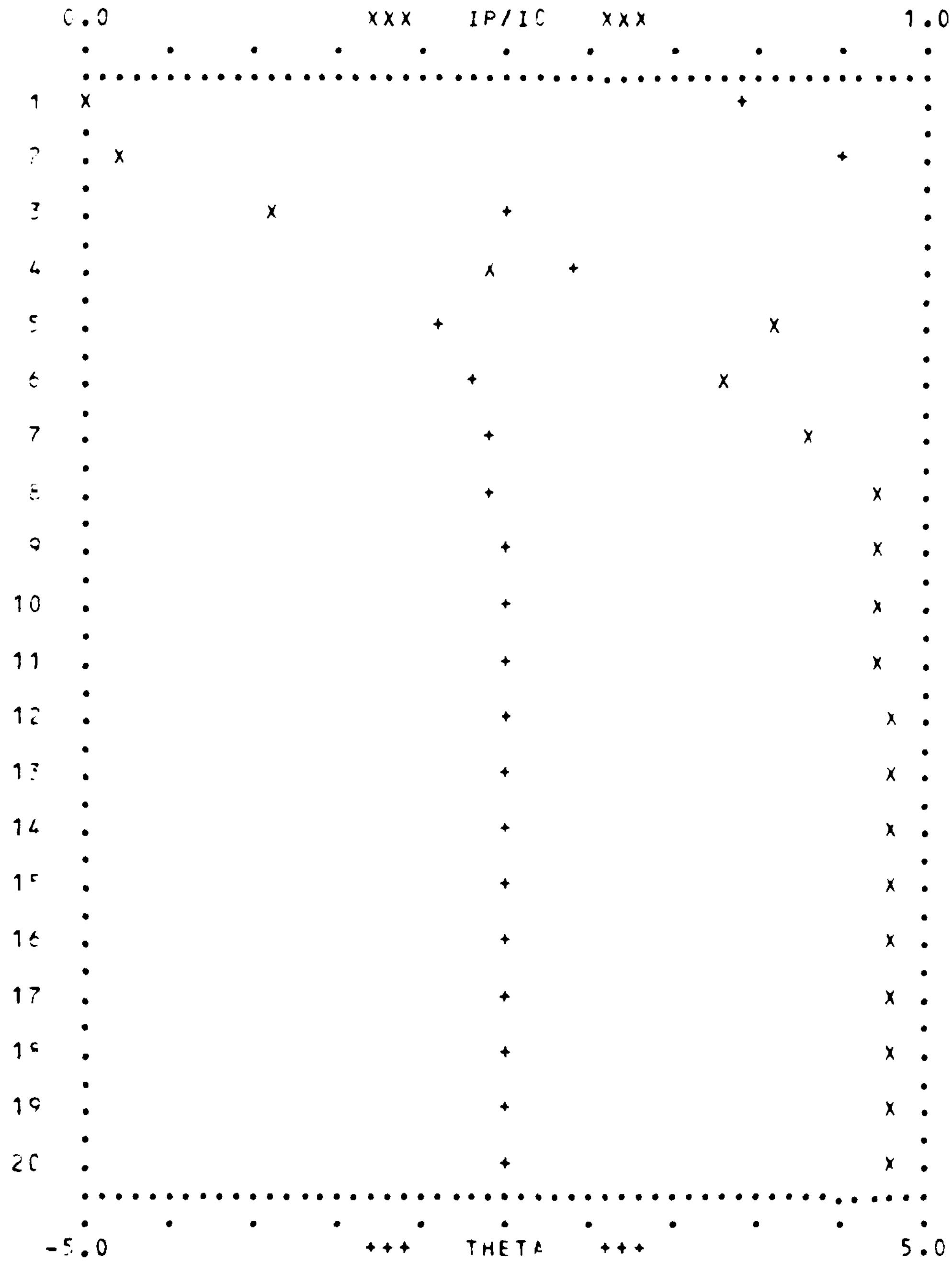

RUN 332. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



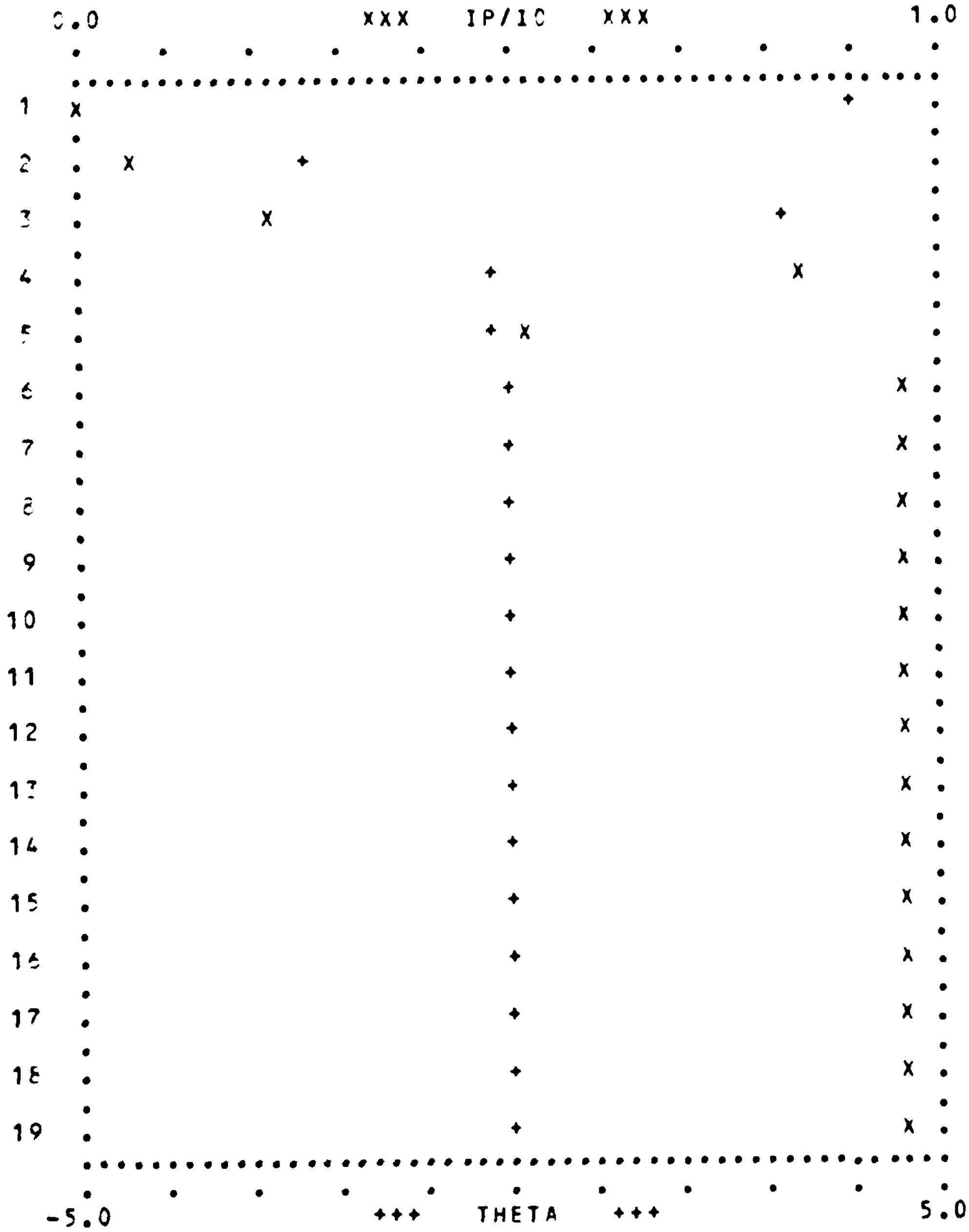

RUN 333. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



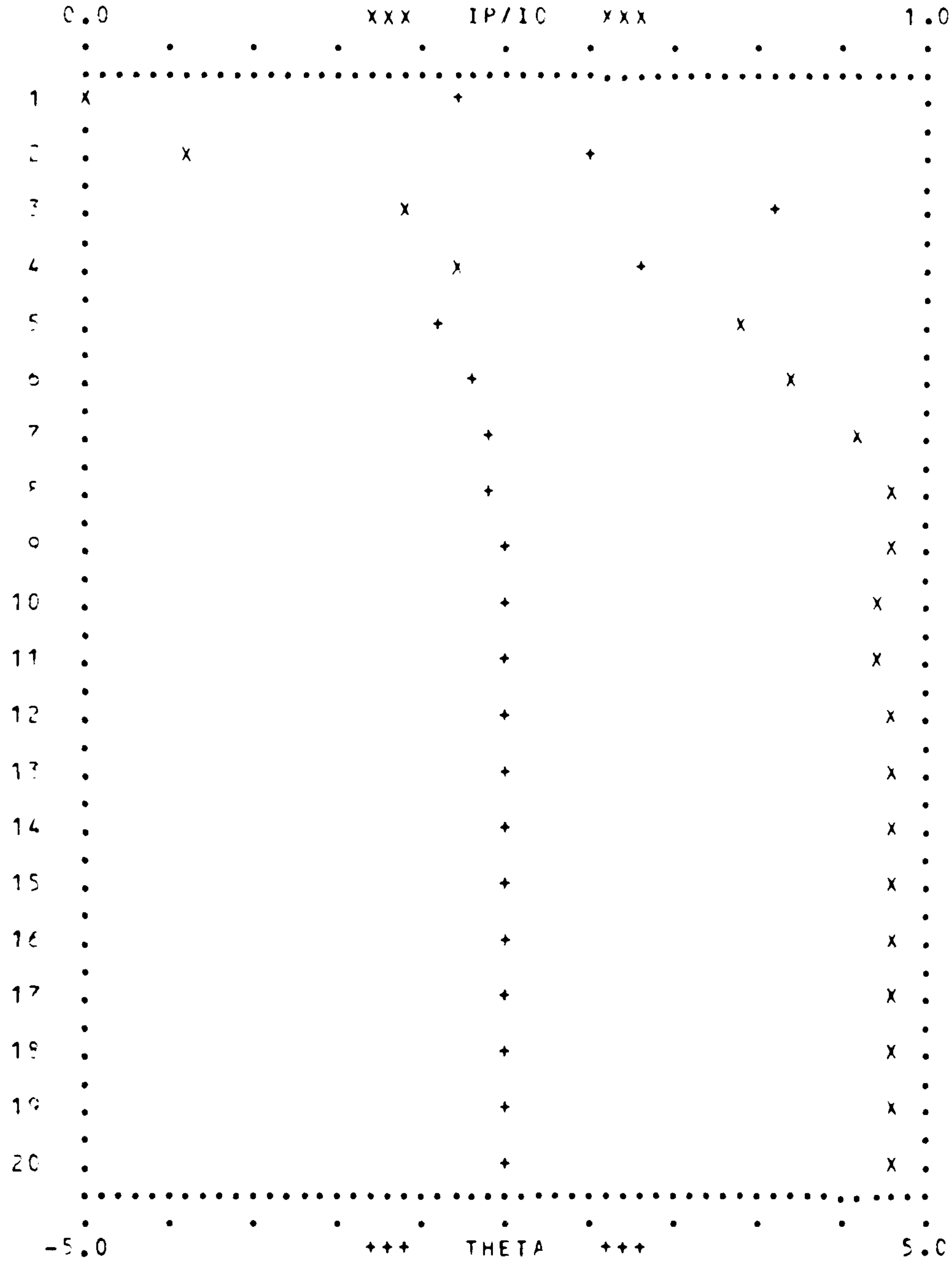

RUN 334. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



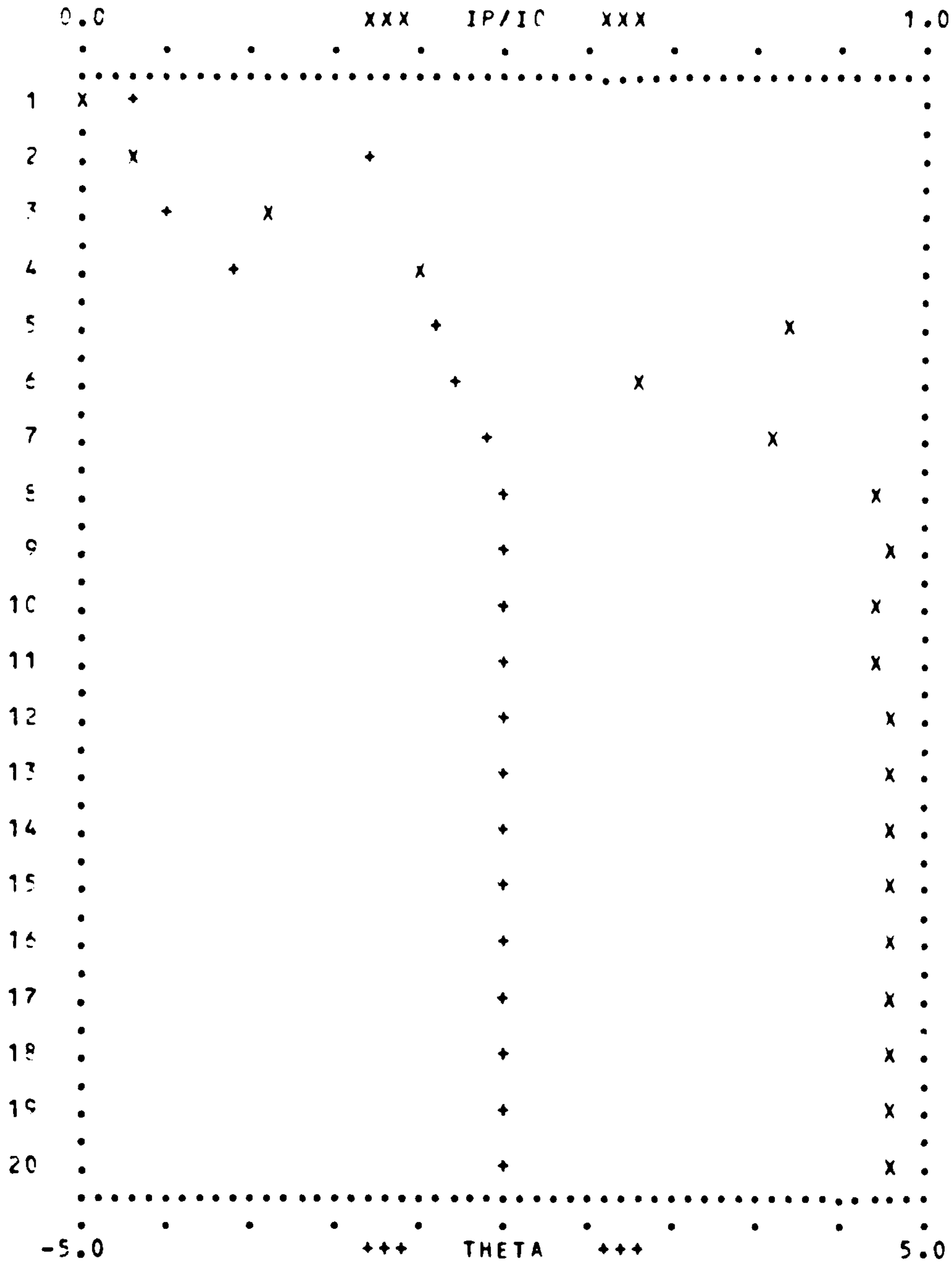

RUN 335. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



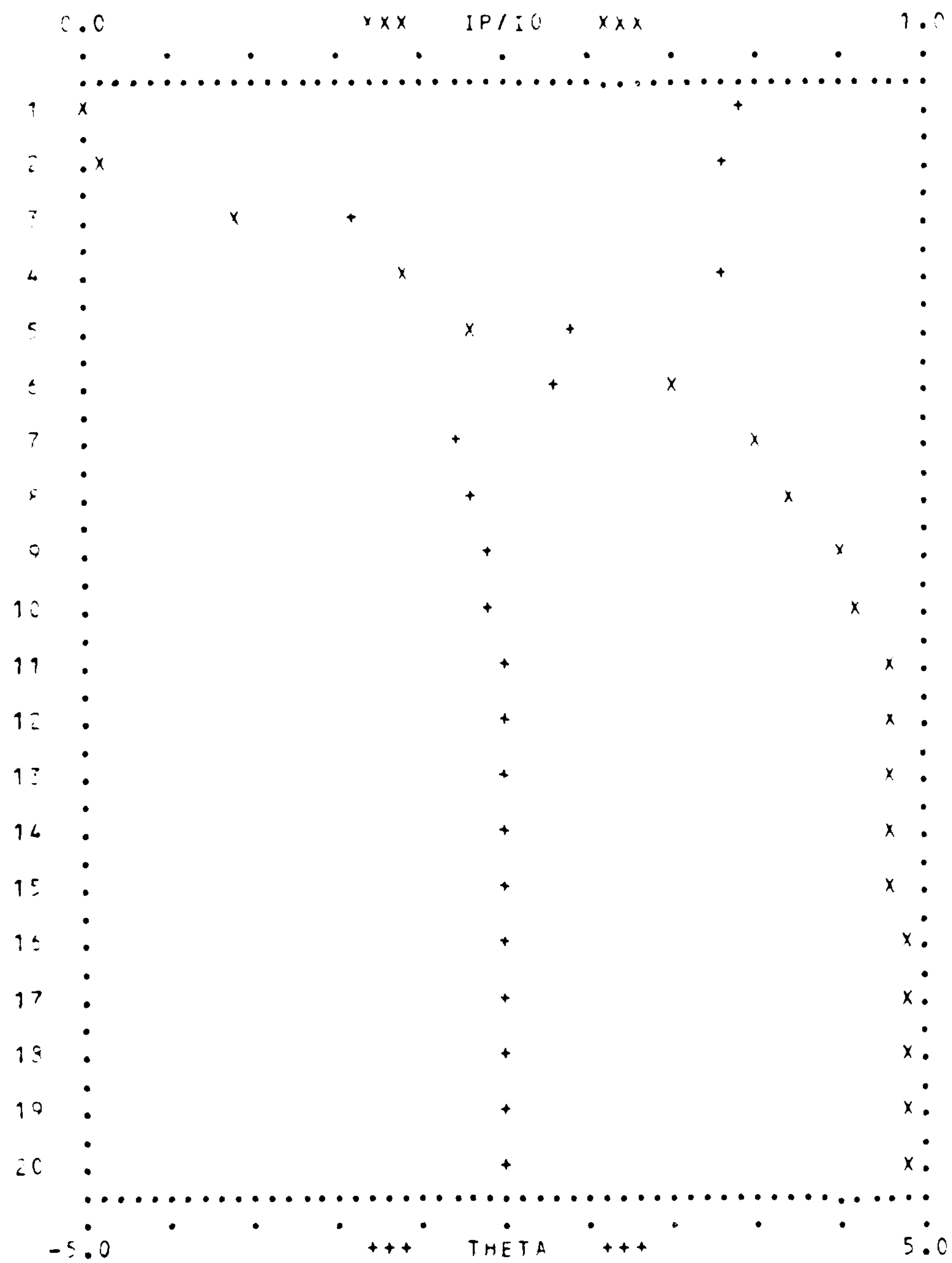

RUN 336. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



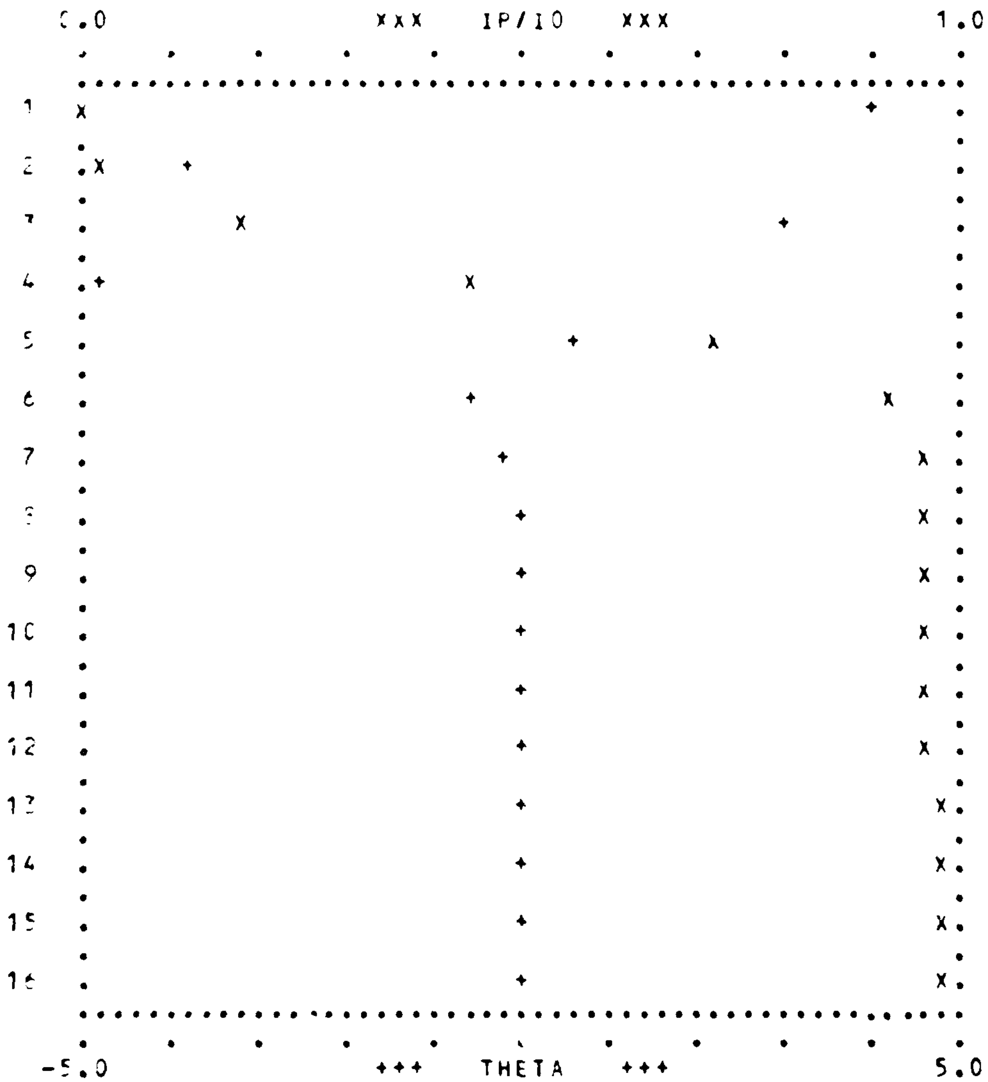
RUN 337. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.92840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



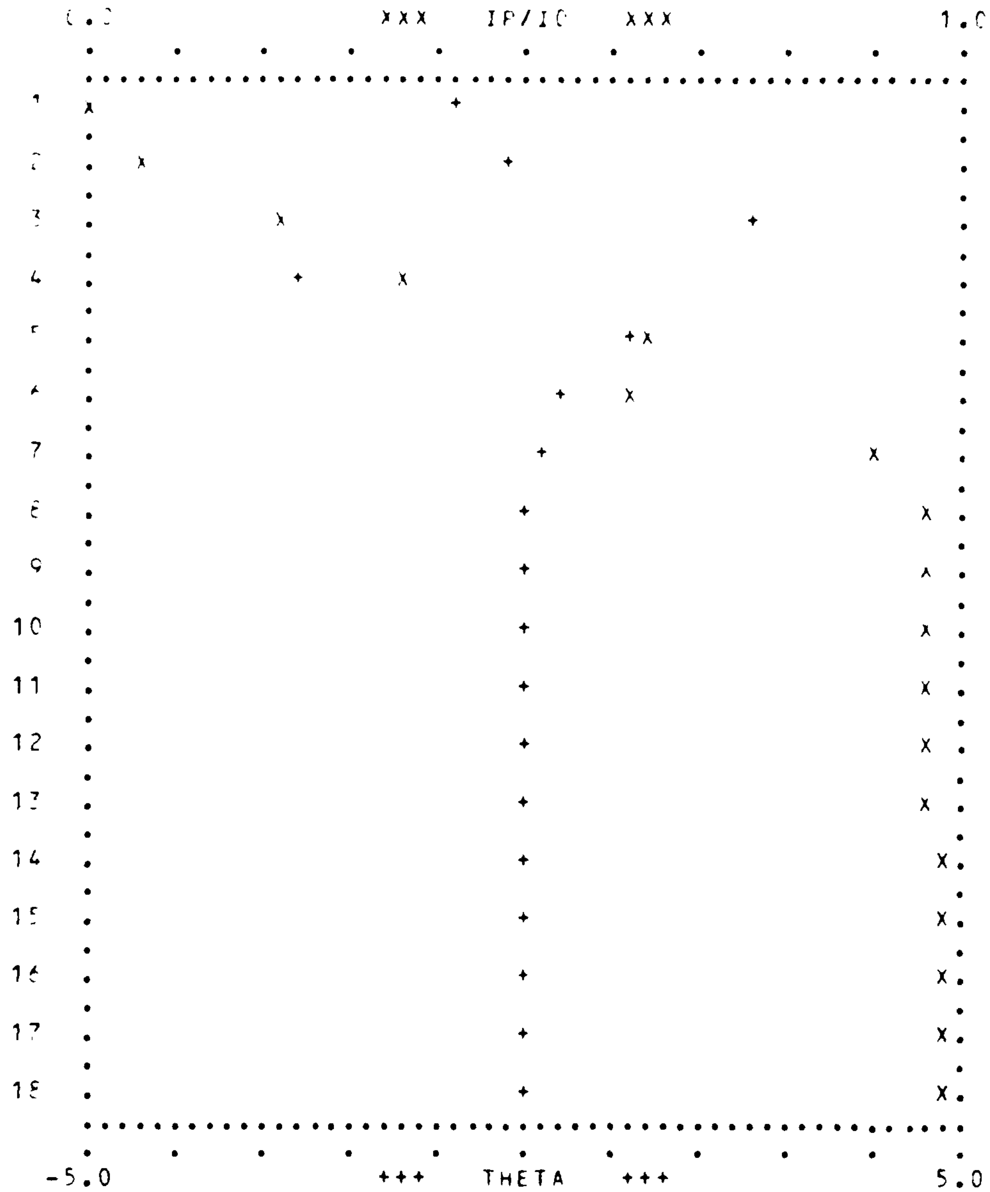

RUN 338. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



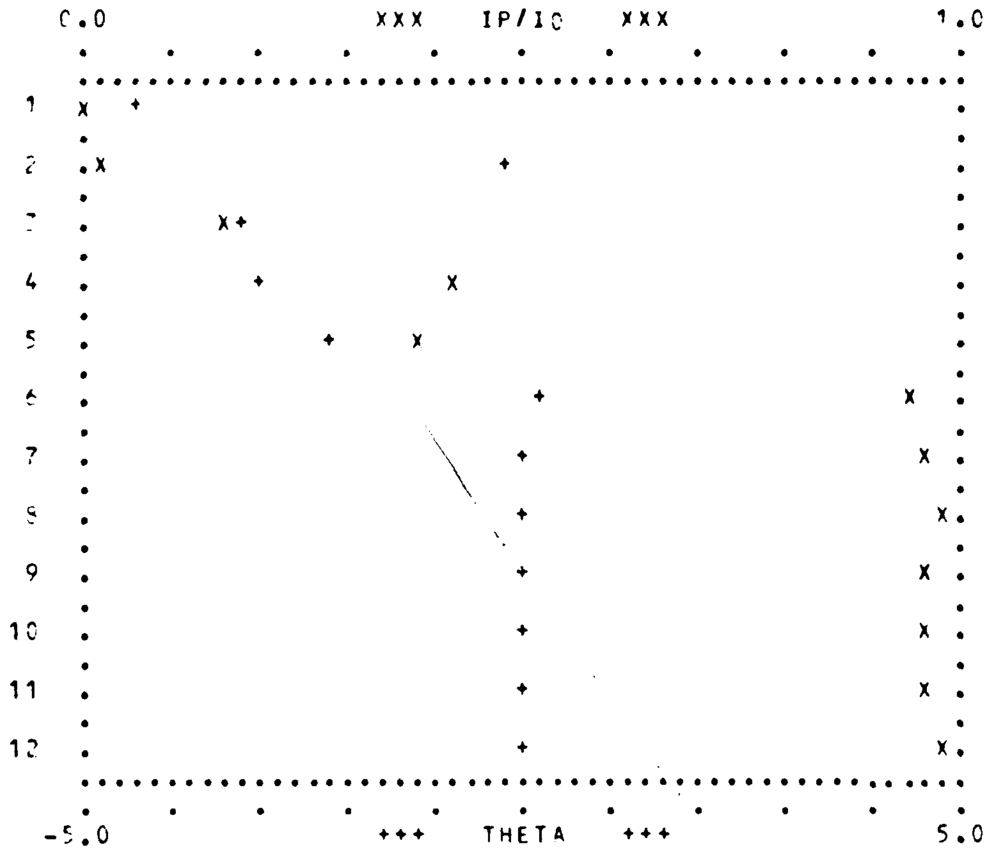

RUN 339. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 707.20000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



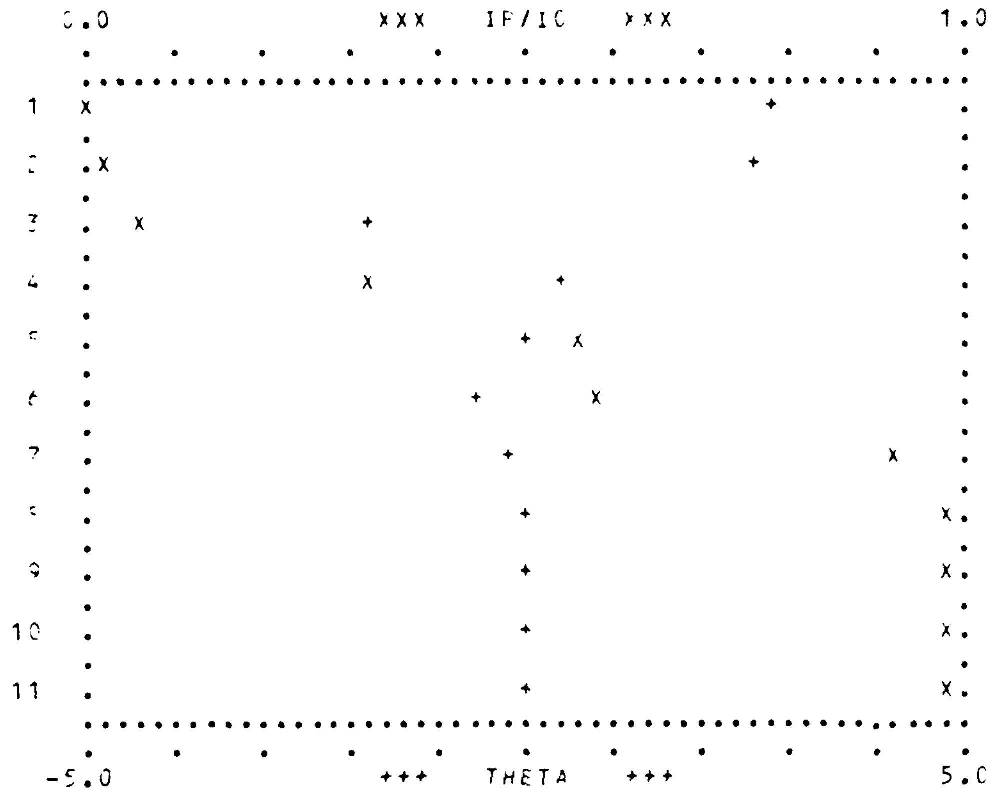

RUN 340. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



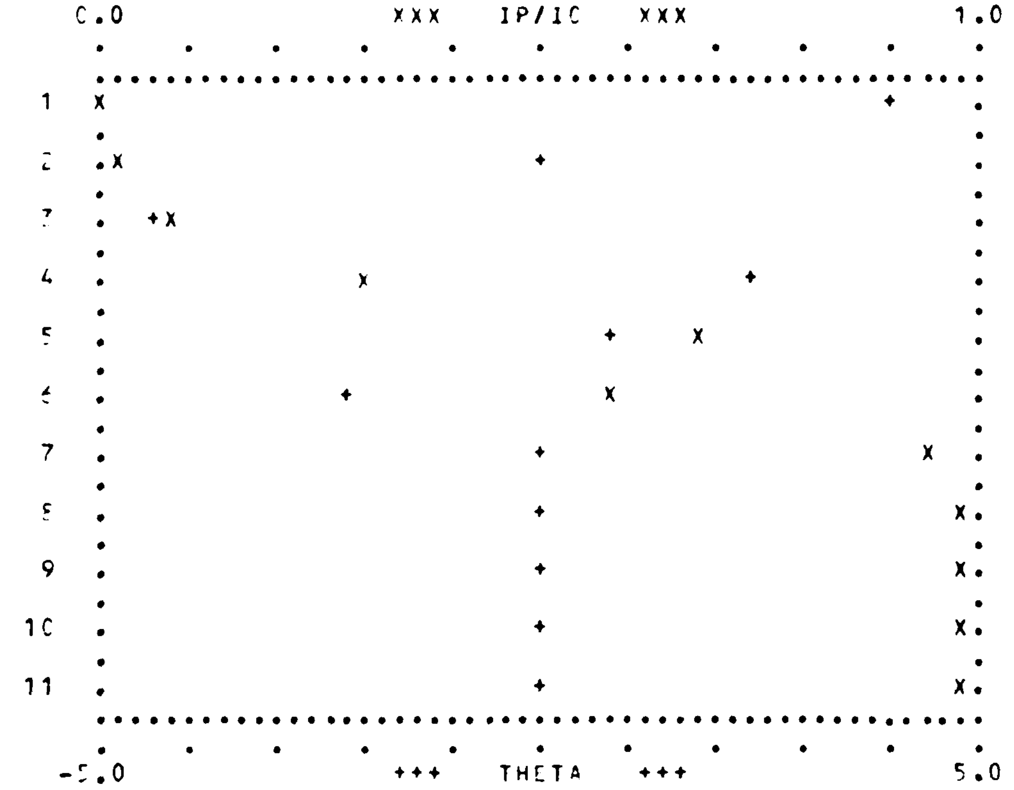

RUN 341. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



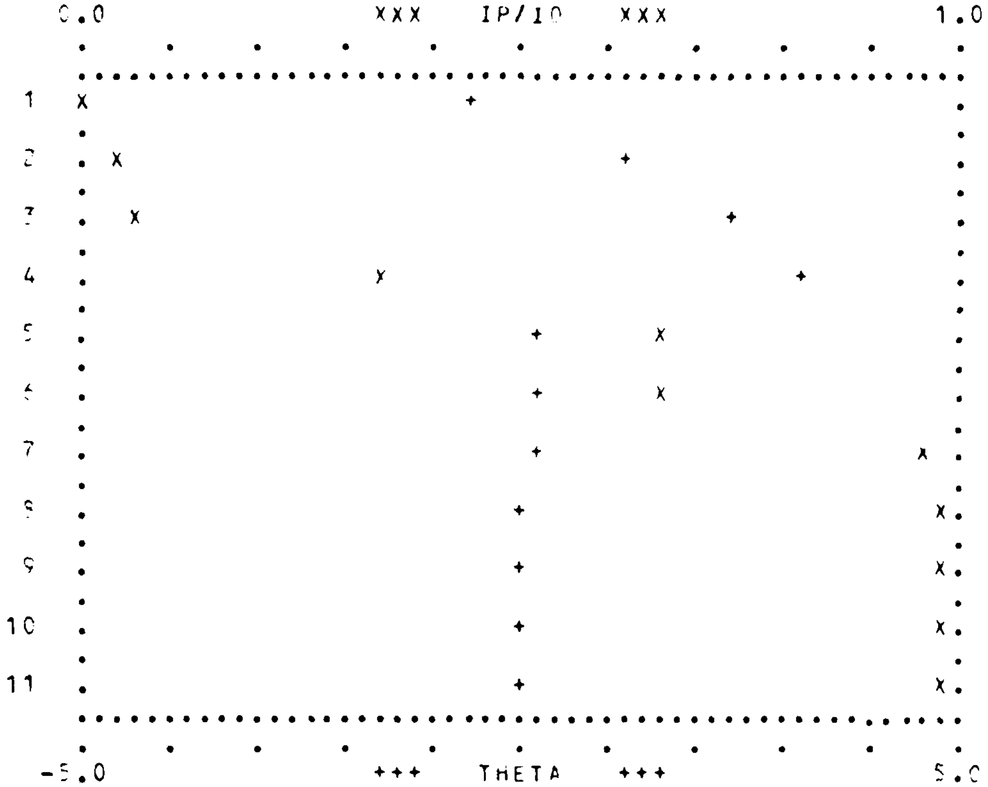

RUN 342. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



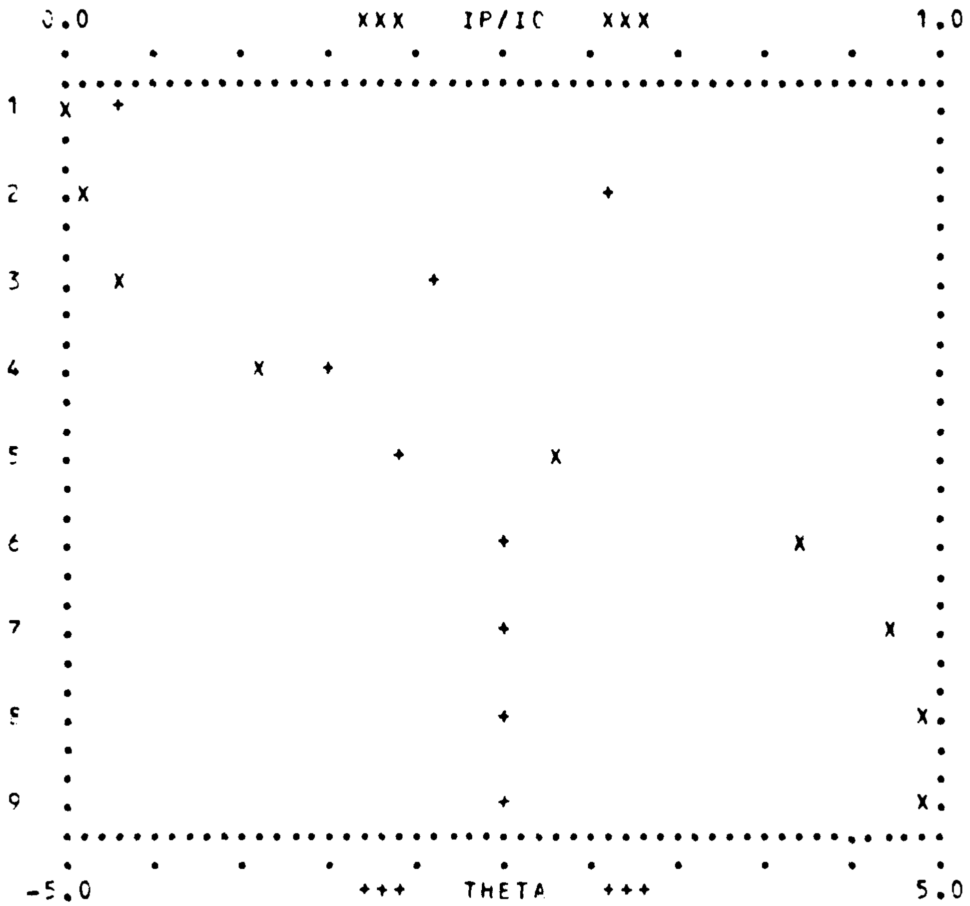

RUN 343. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



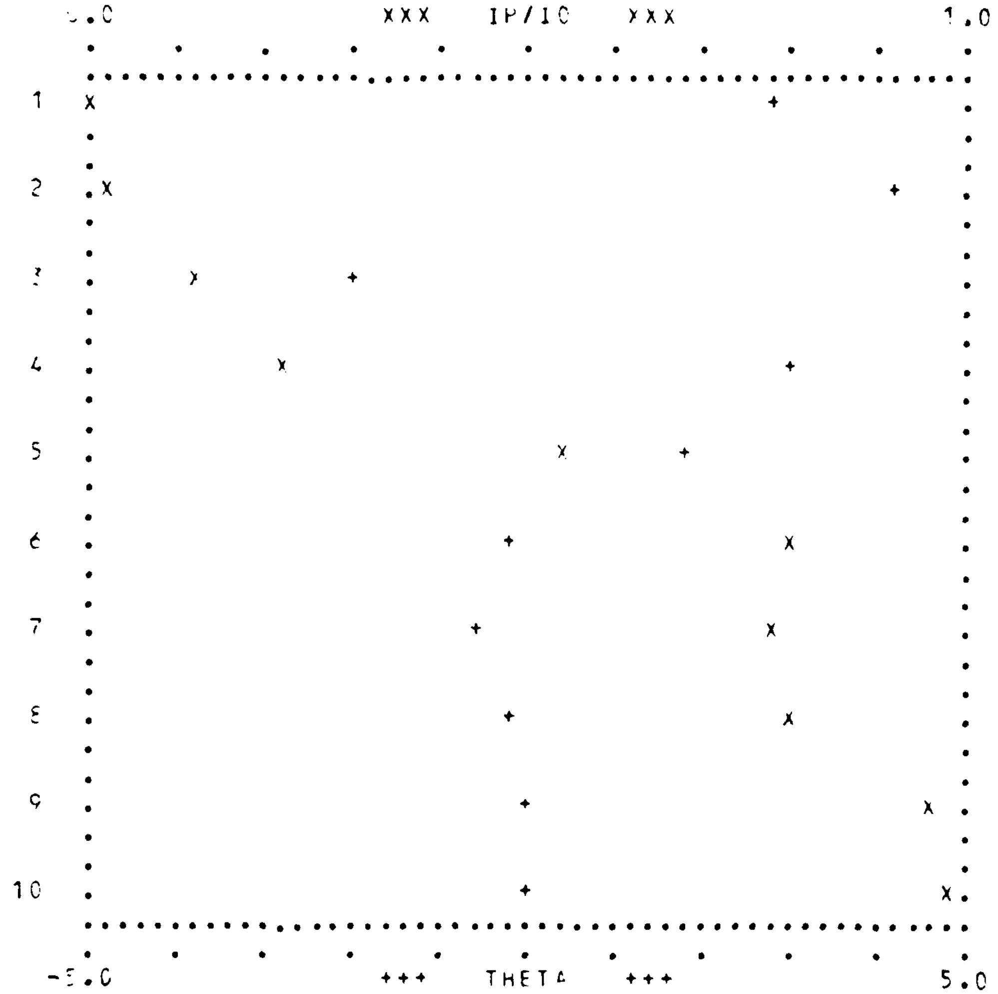

RUN 344. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



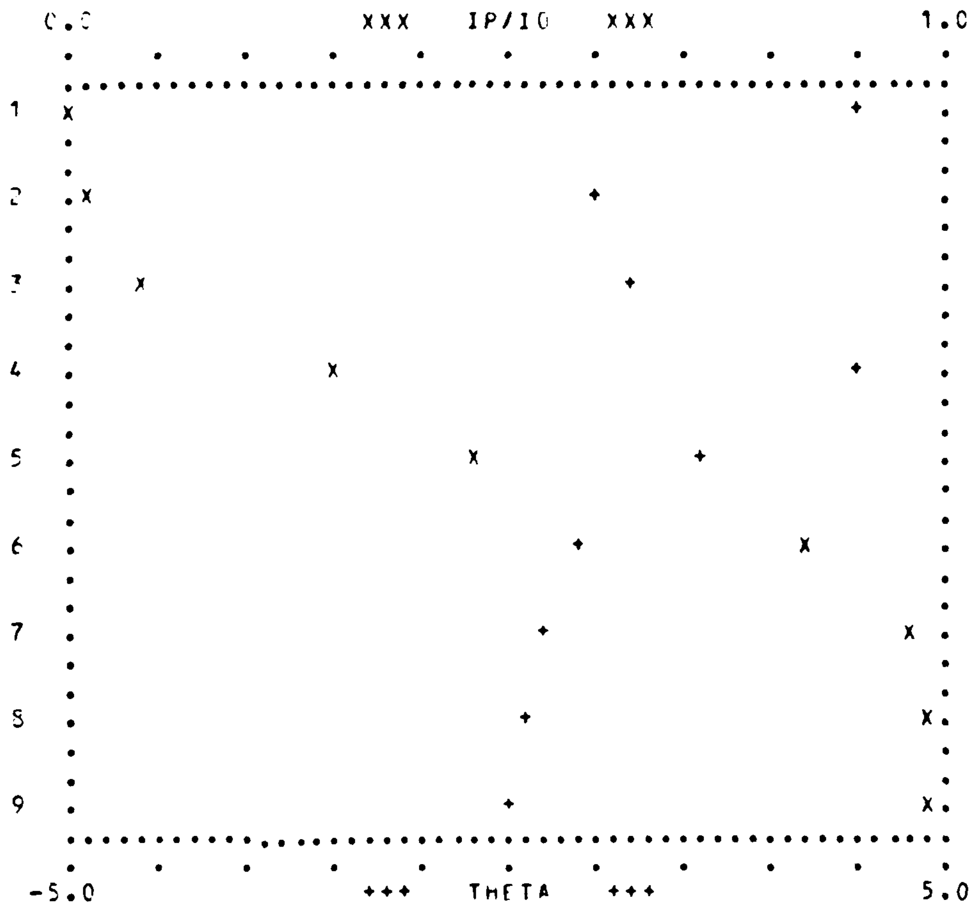

RUN 345. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



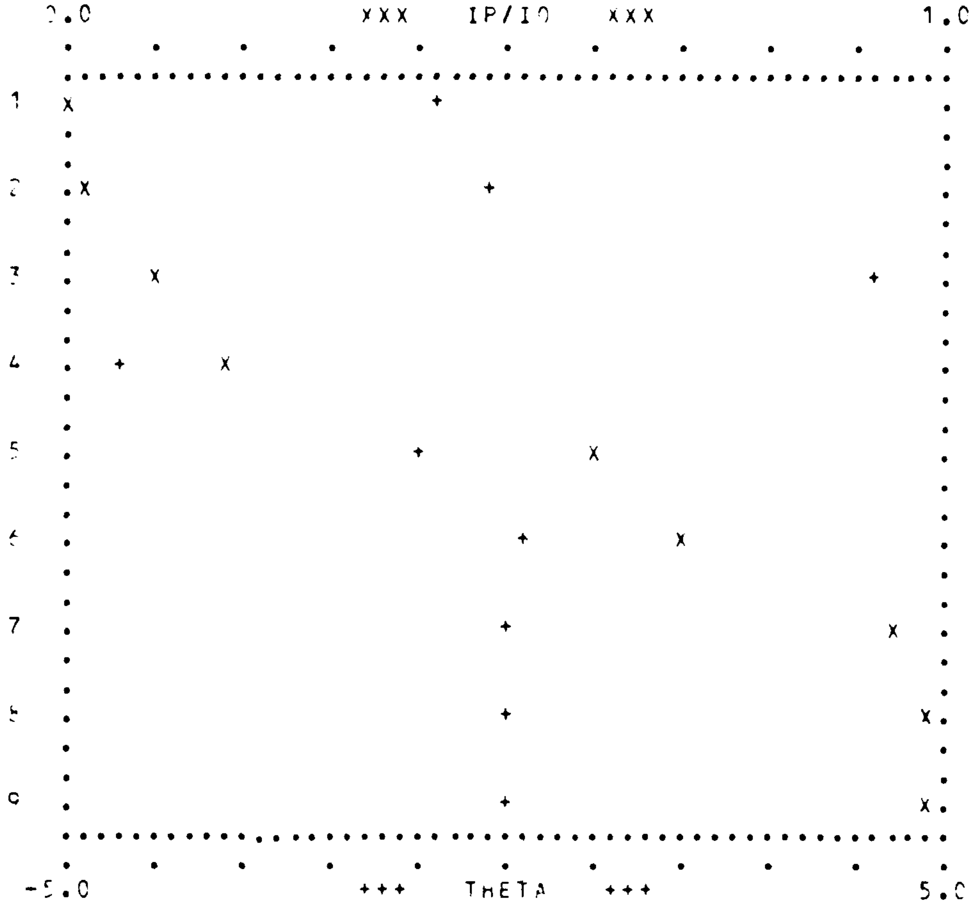

RUN 346. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



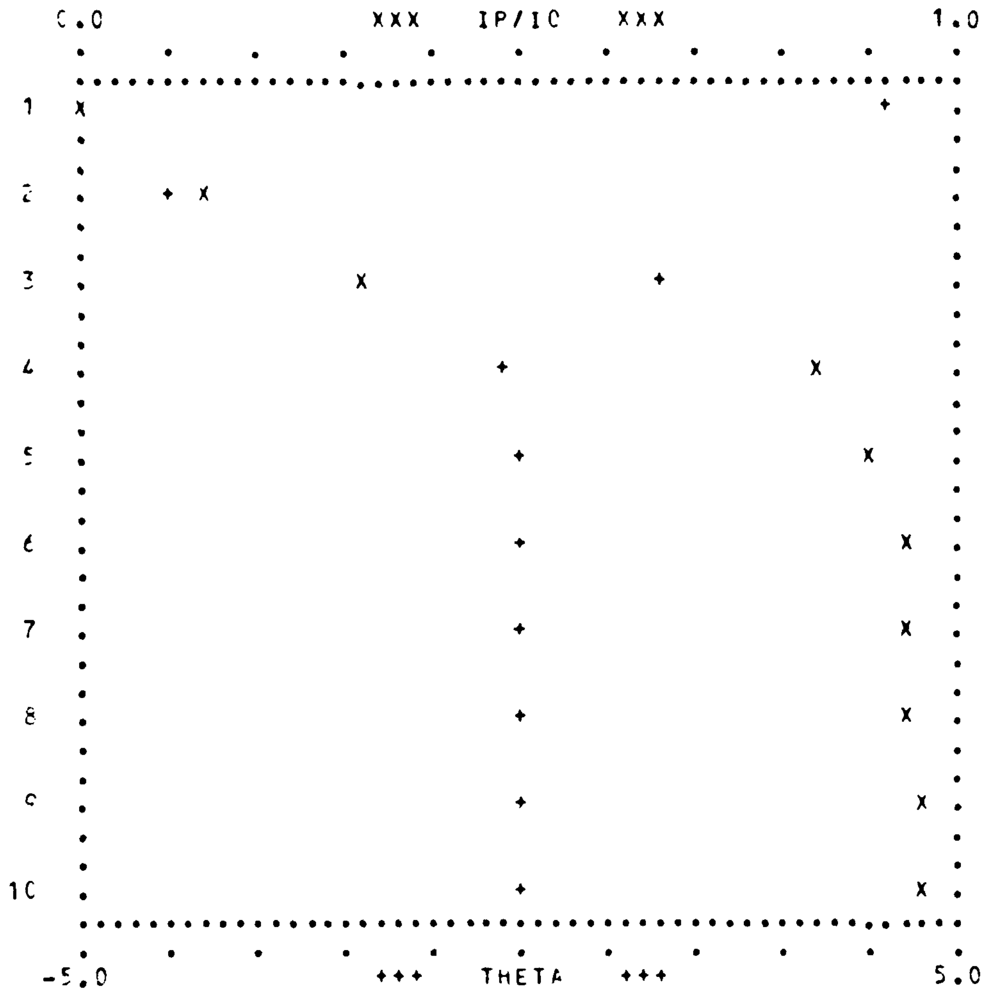

RUN 347. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.82840 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



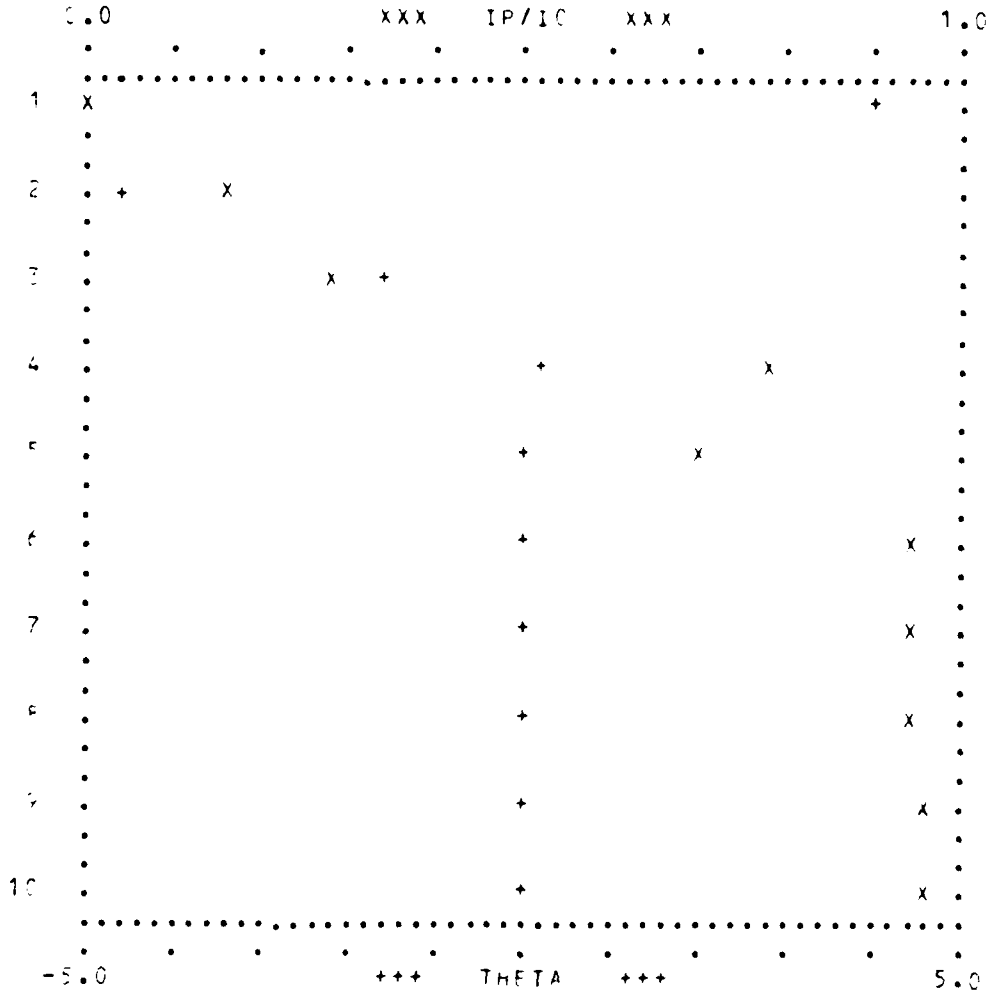

RUN 348. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



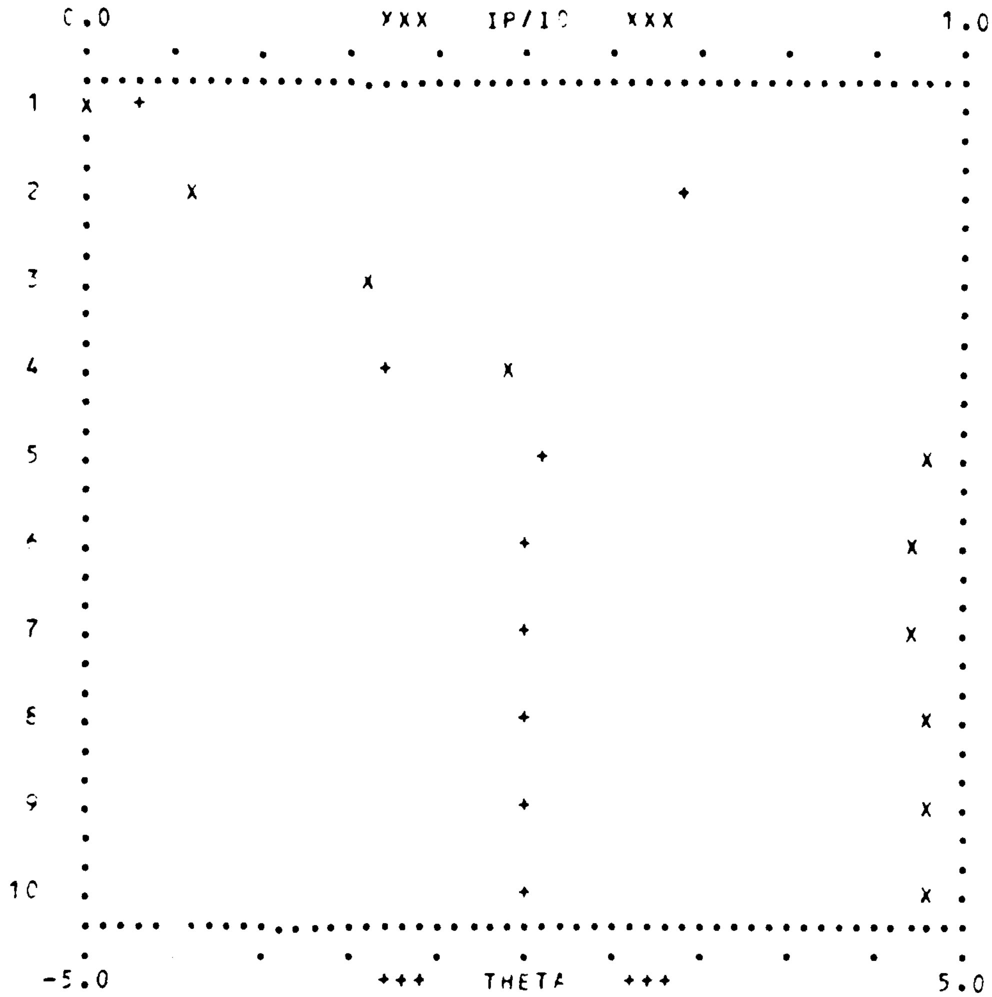

RUN 349. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.82840
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



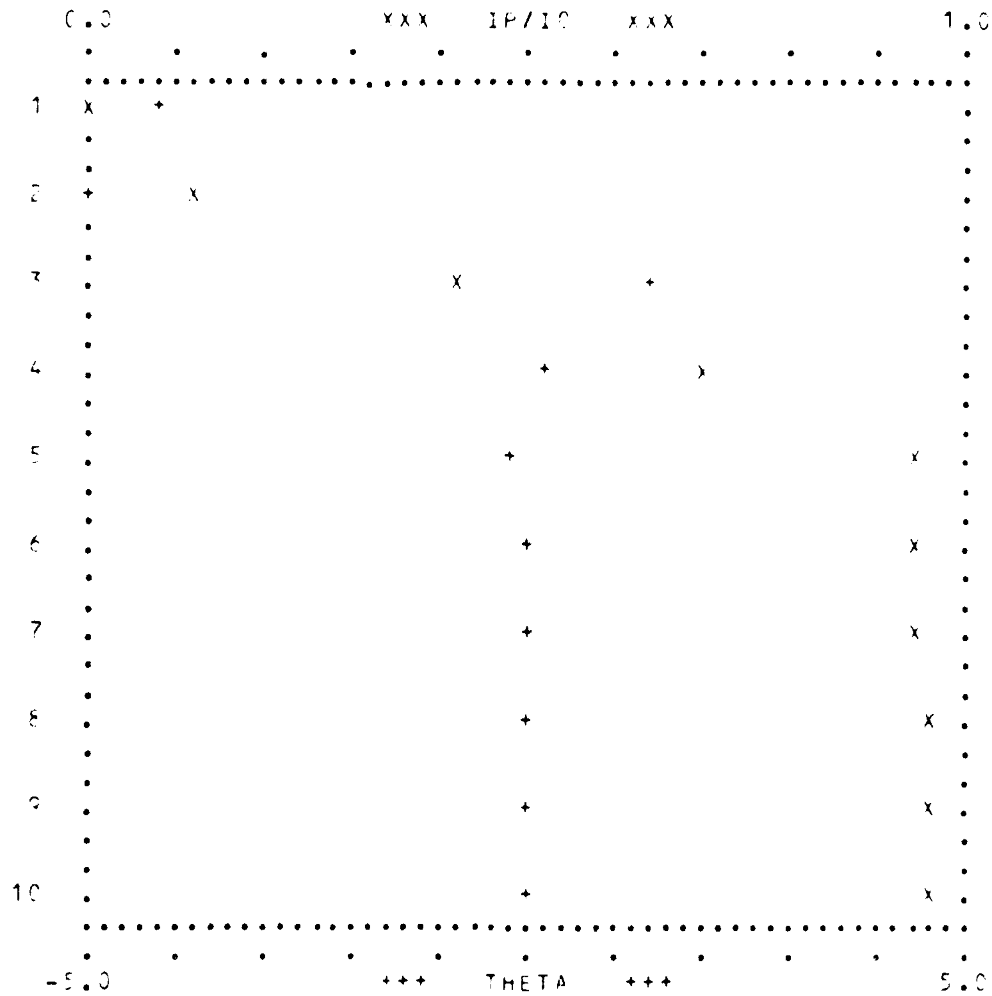

RUN 351. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=4.00002
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.




RUN 352. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



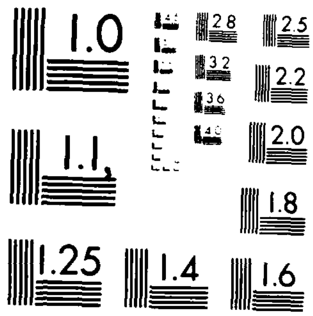

RUN 353. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=4.00002
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.




RUN 354. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.

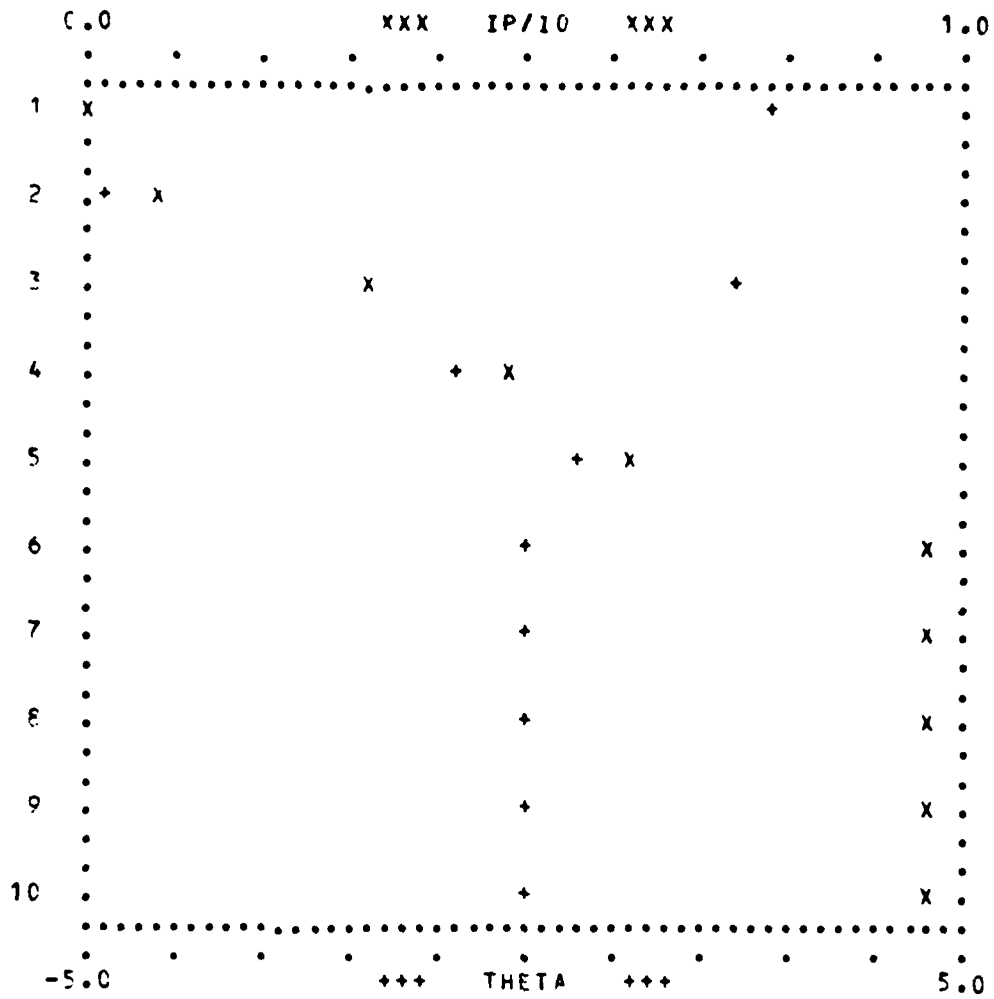
AD-A131 887 WAVE OPTICS INVESTIGATIONS OF TRANSVERSE MODE FORMATION (U) ARMY MISSILE COMMAND REDSTONE ARSENAL AL DIRECTED ENERGY DIRECTORATE R W JONES ET AL. MAR 82 2/3

UNCLASSIFIED DRSMI/RH-82-4-TR SBI-AD-E950 422 F/G 20/5 NL

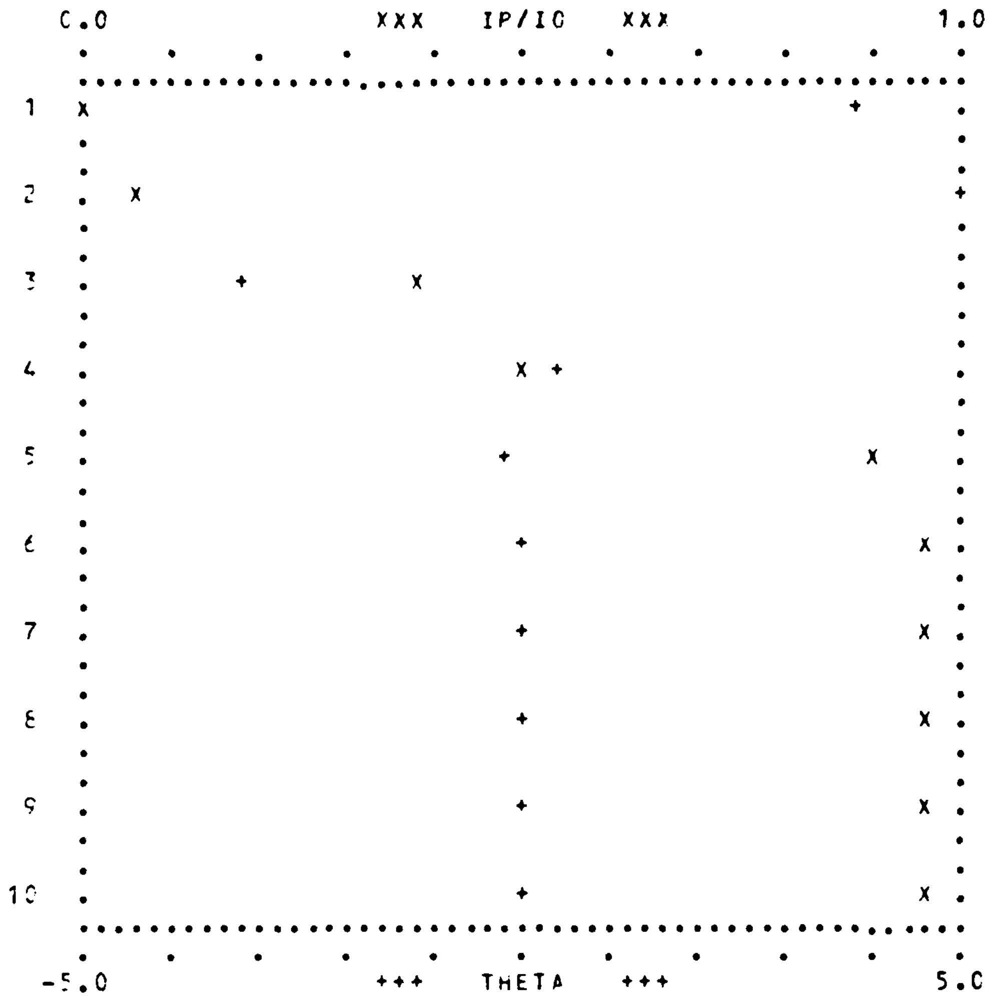



MICROCOPY RESOLUTION TEST CHART

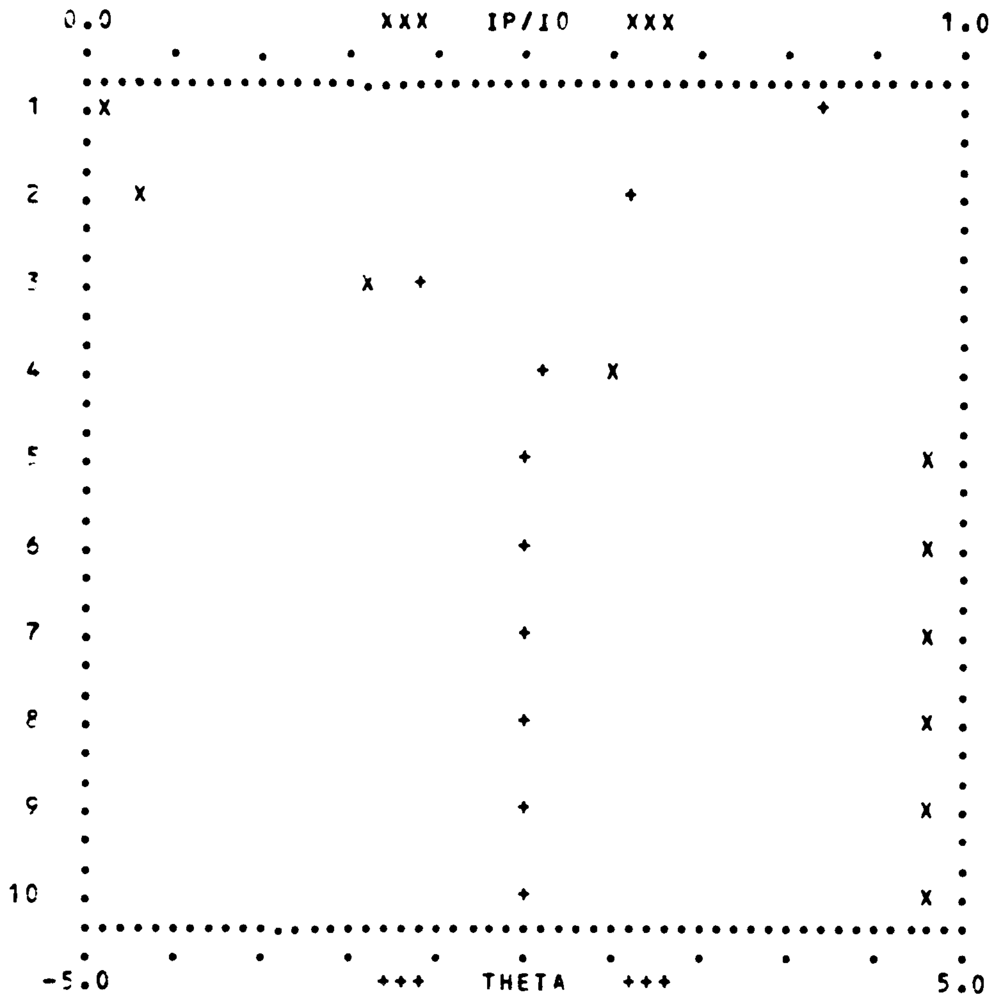
NATIONAL [illegible]



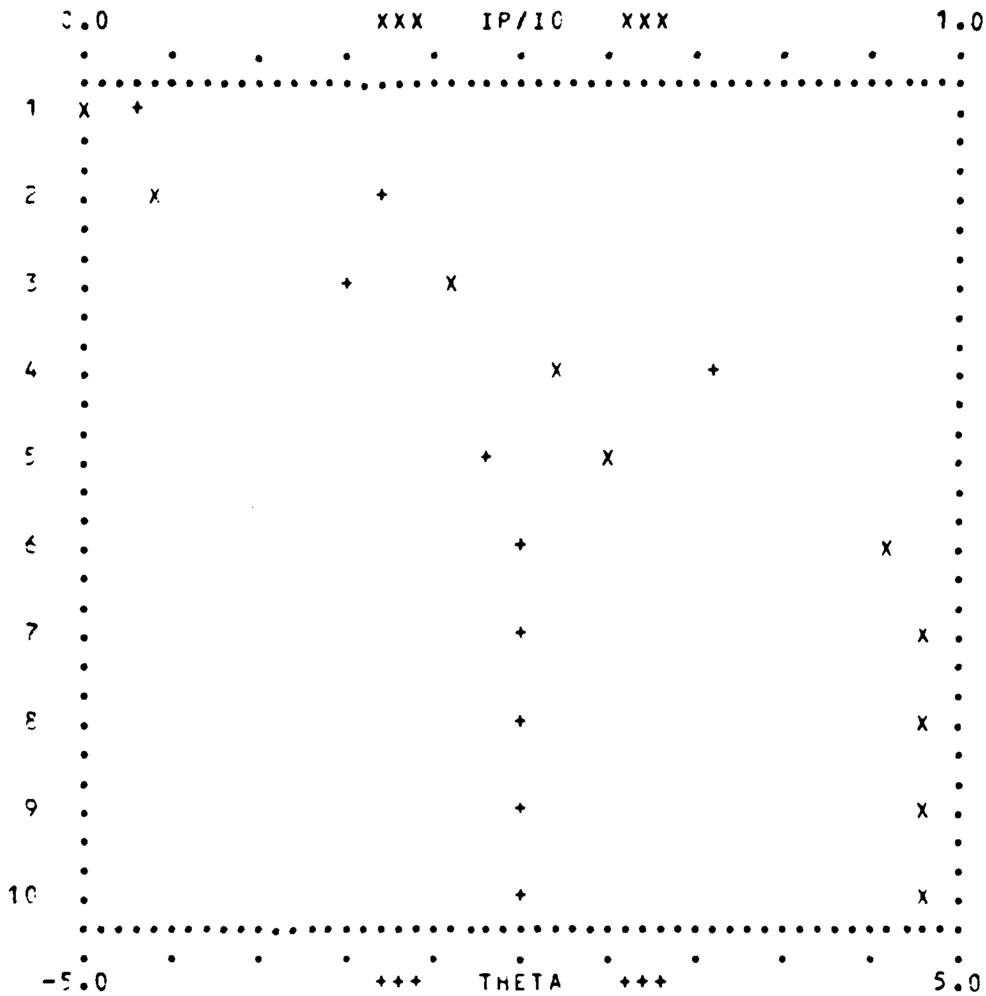

RUN 355. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



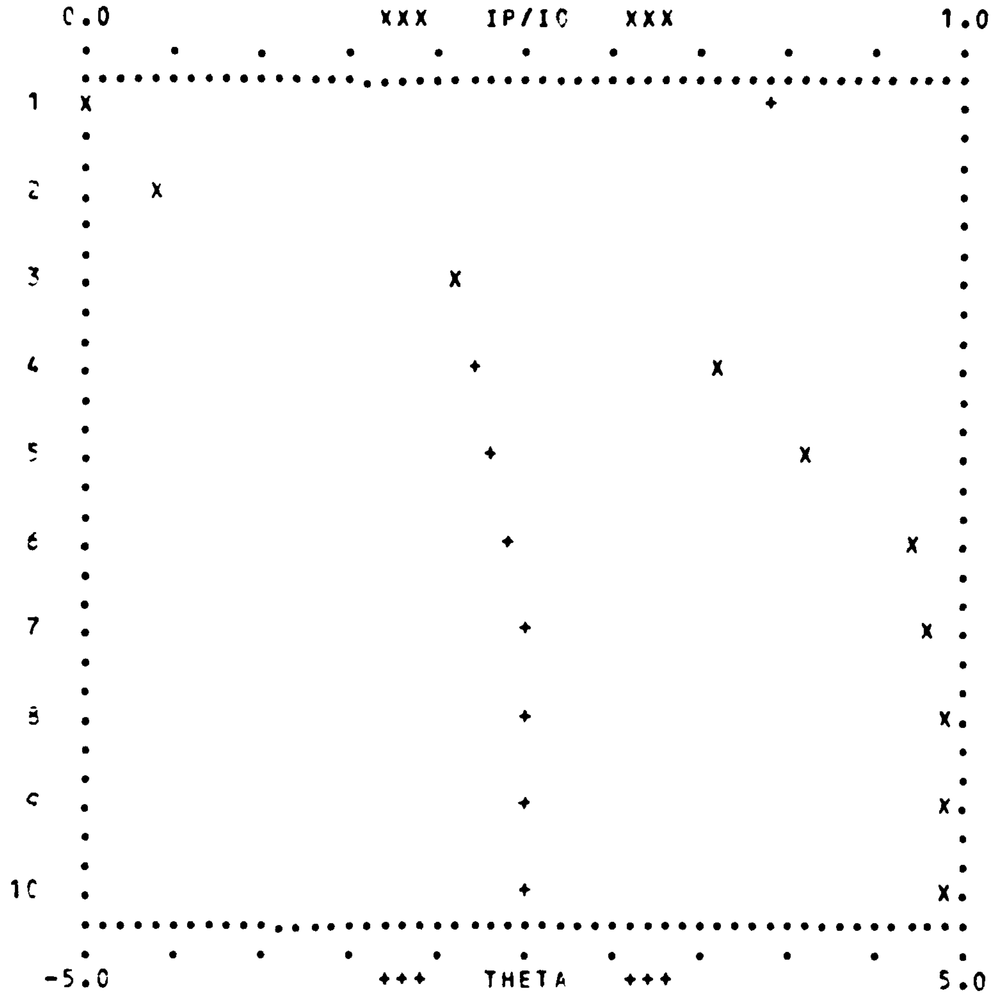

RUN 356. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



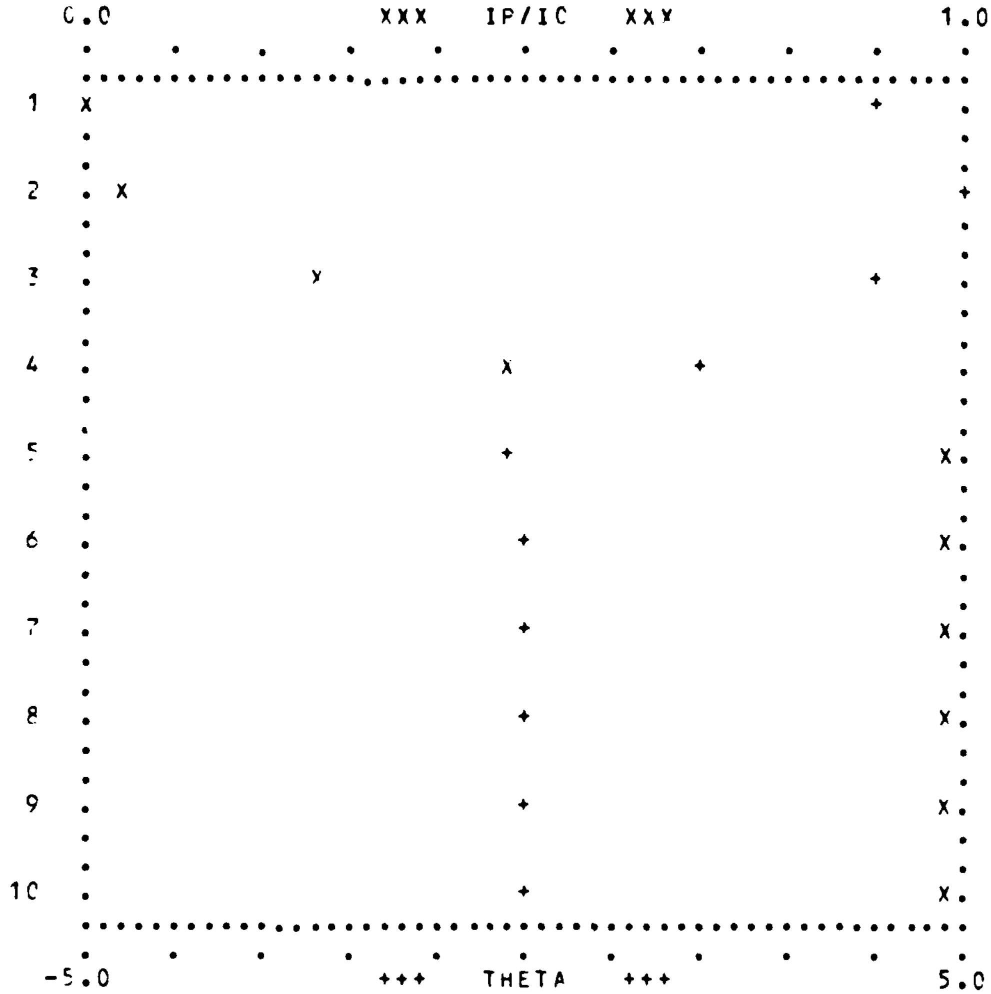

RUN 357. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



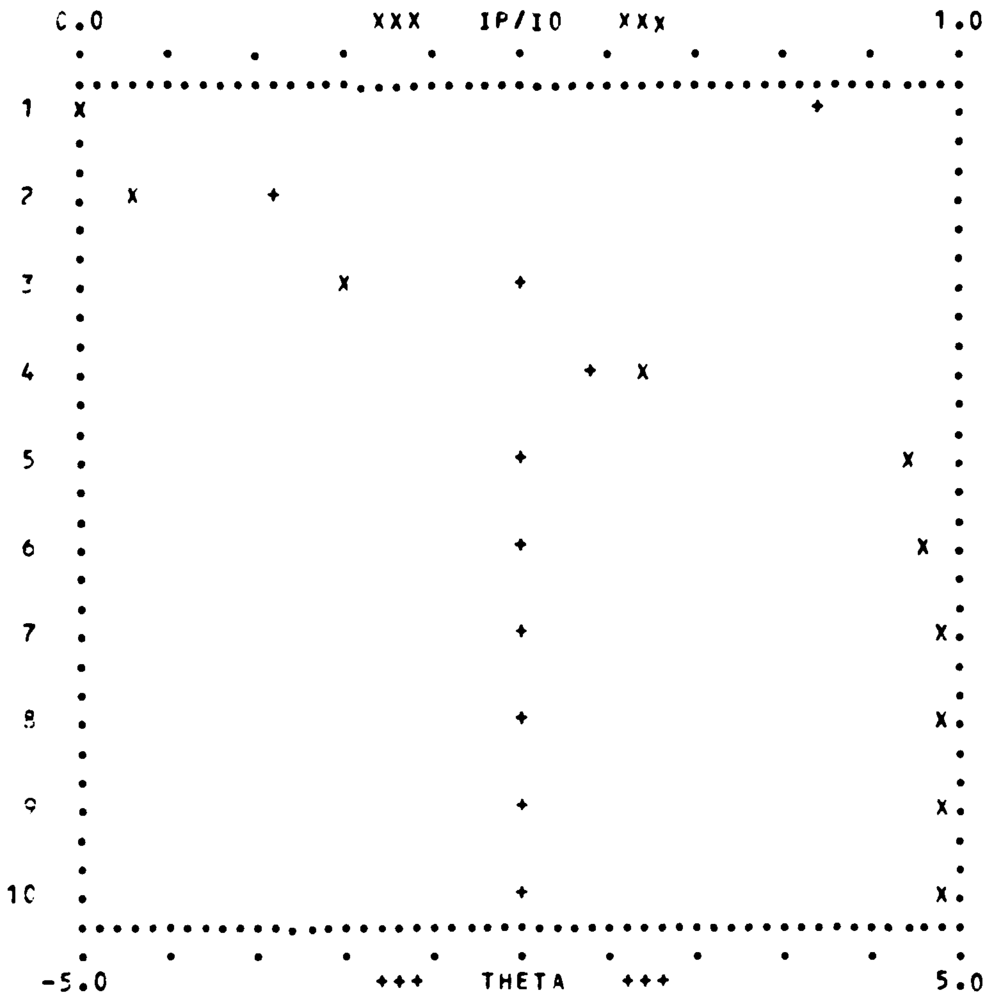

RUN 358. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



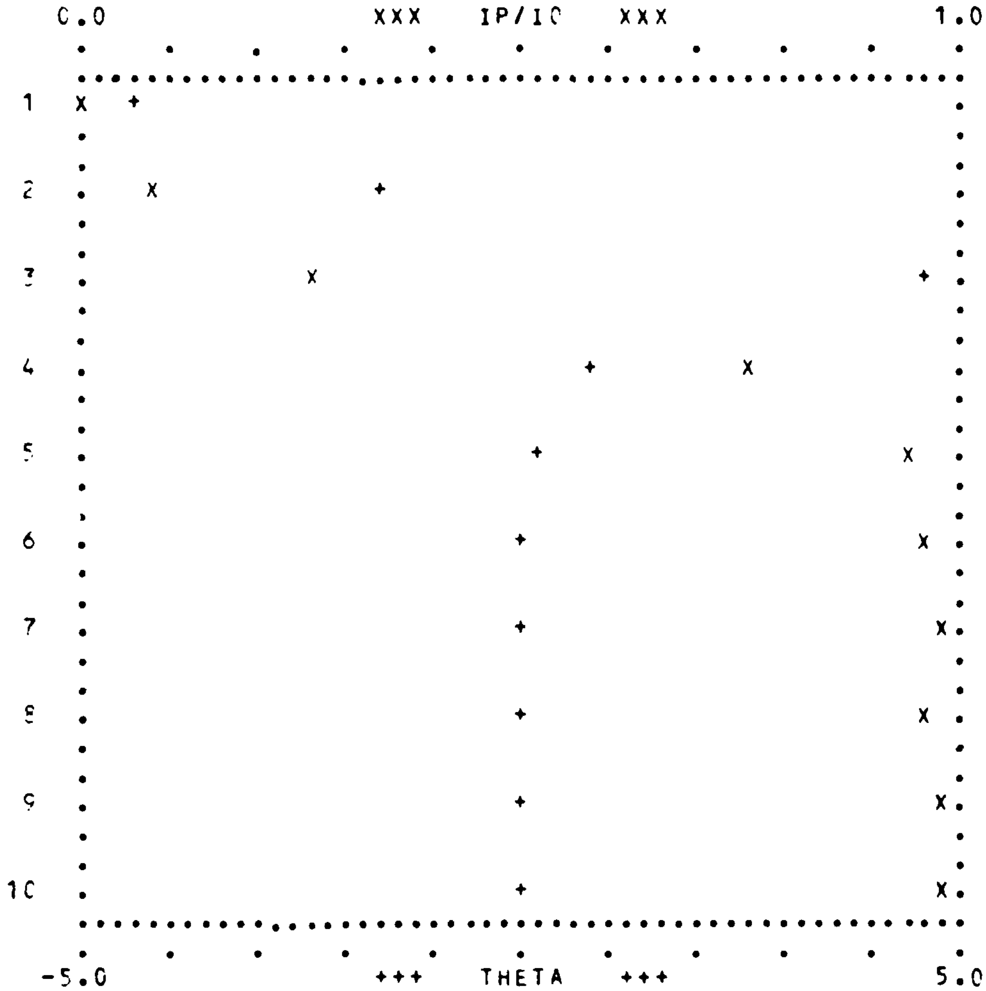

RUN 359. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=4.00002
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



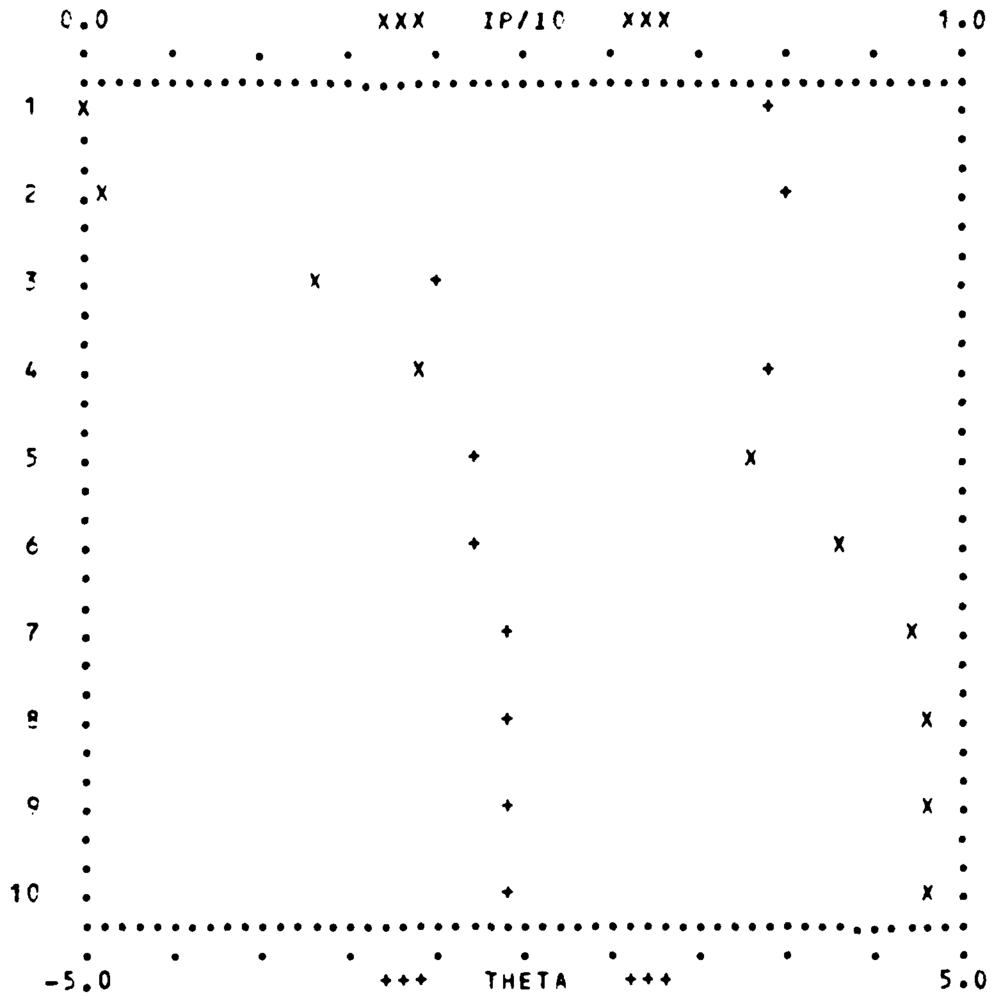

RUN 360. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=4.00002
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



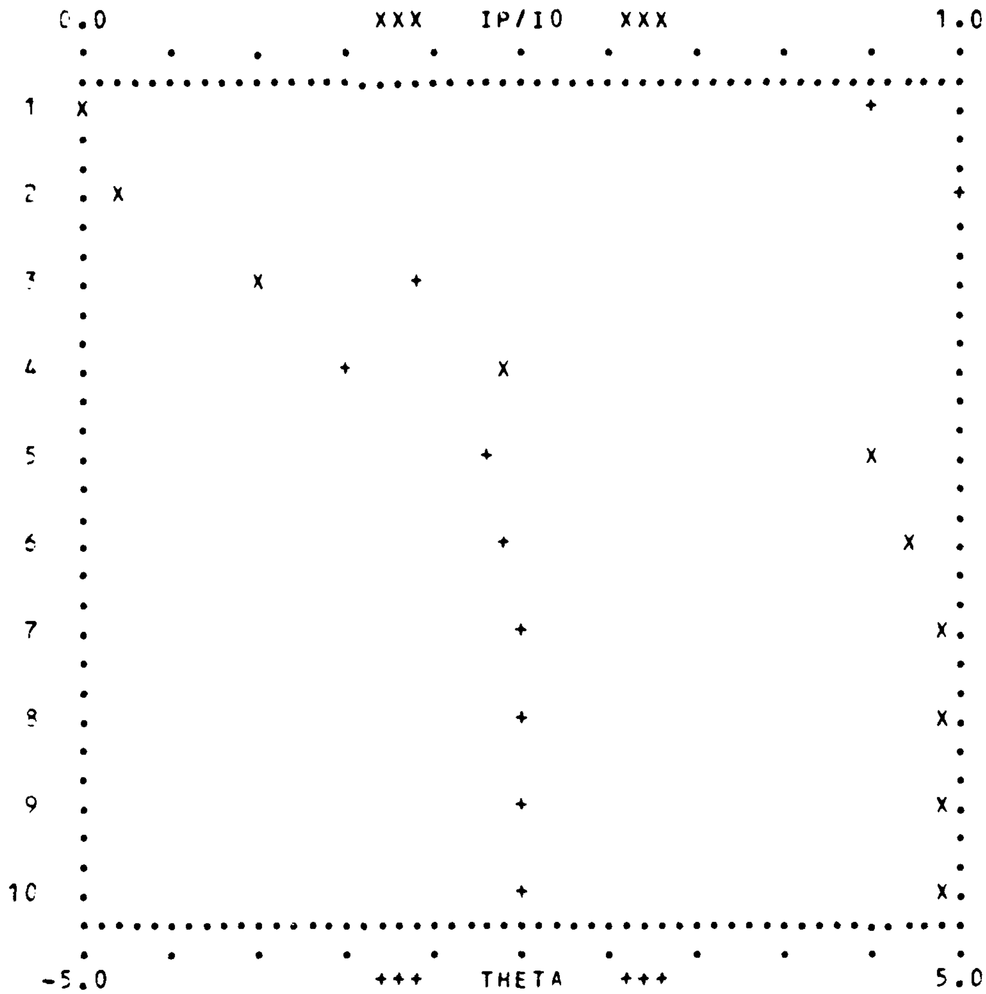

RUN 361. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



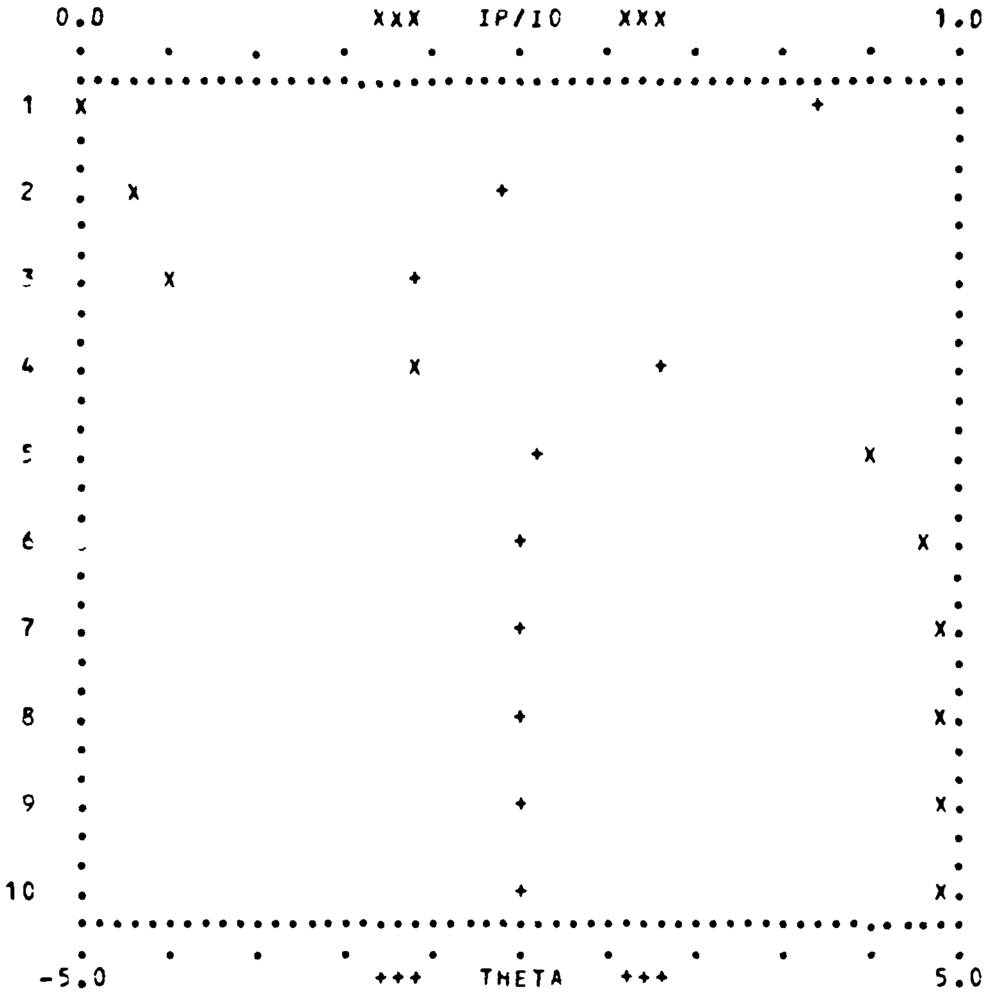

RUN 362. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=4.00002
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



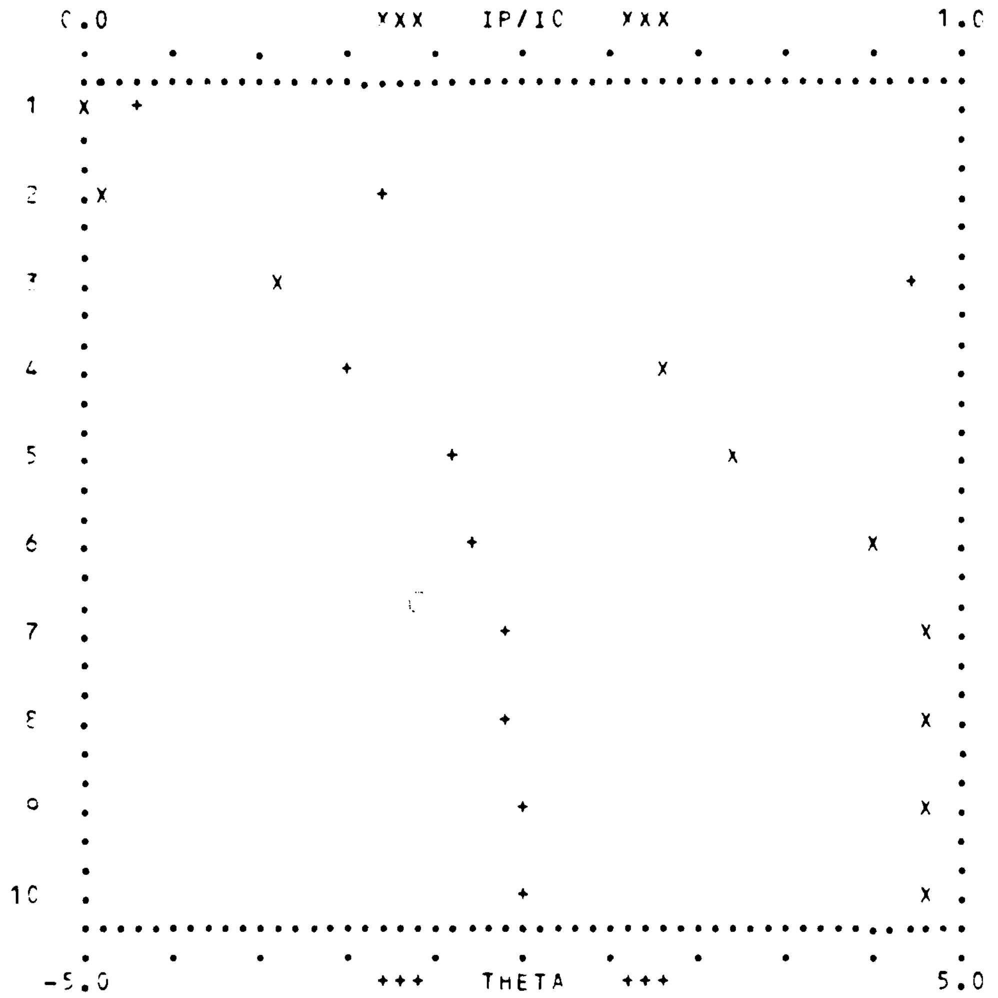

RUN 363. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



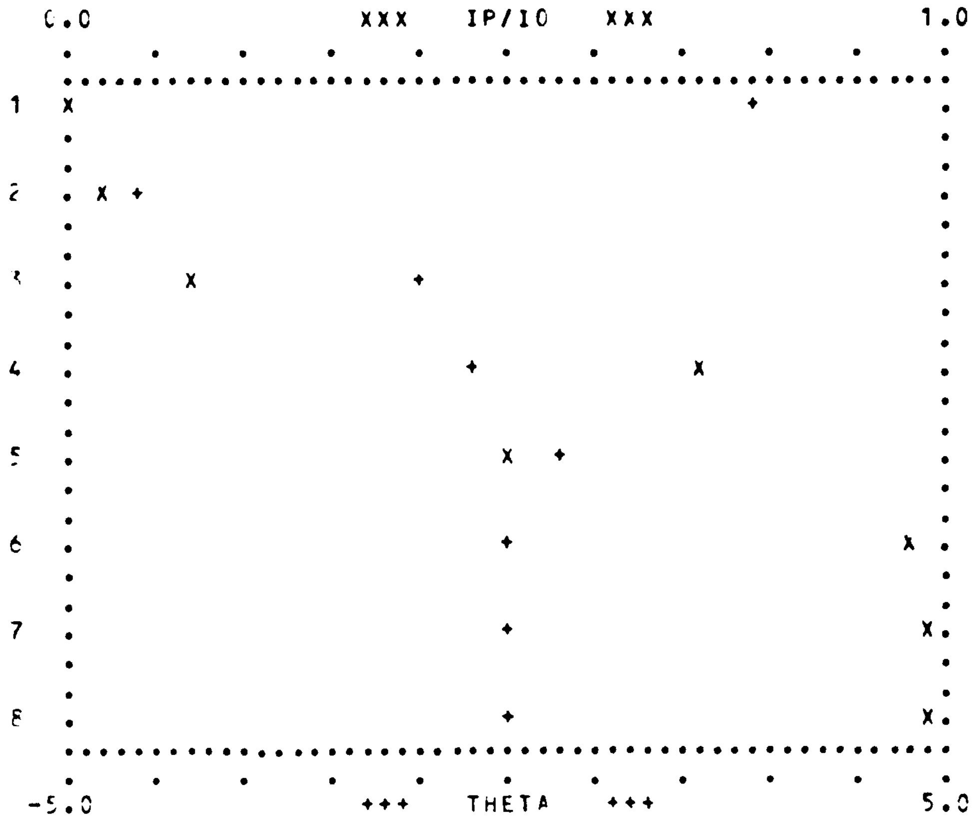

RUN 364. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



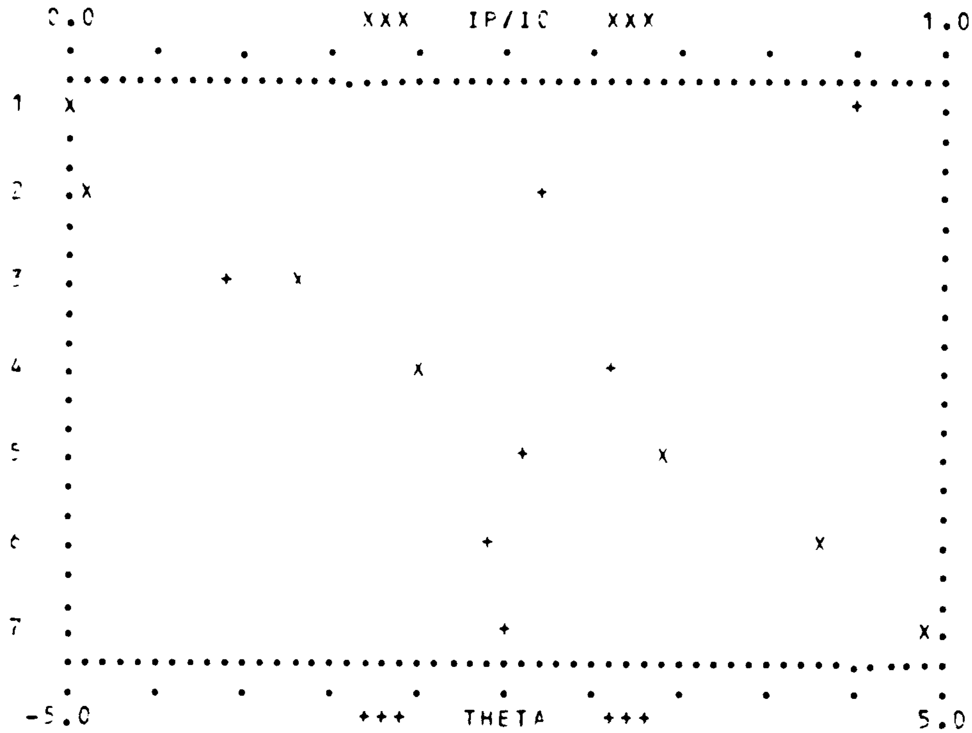

RUN 365. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



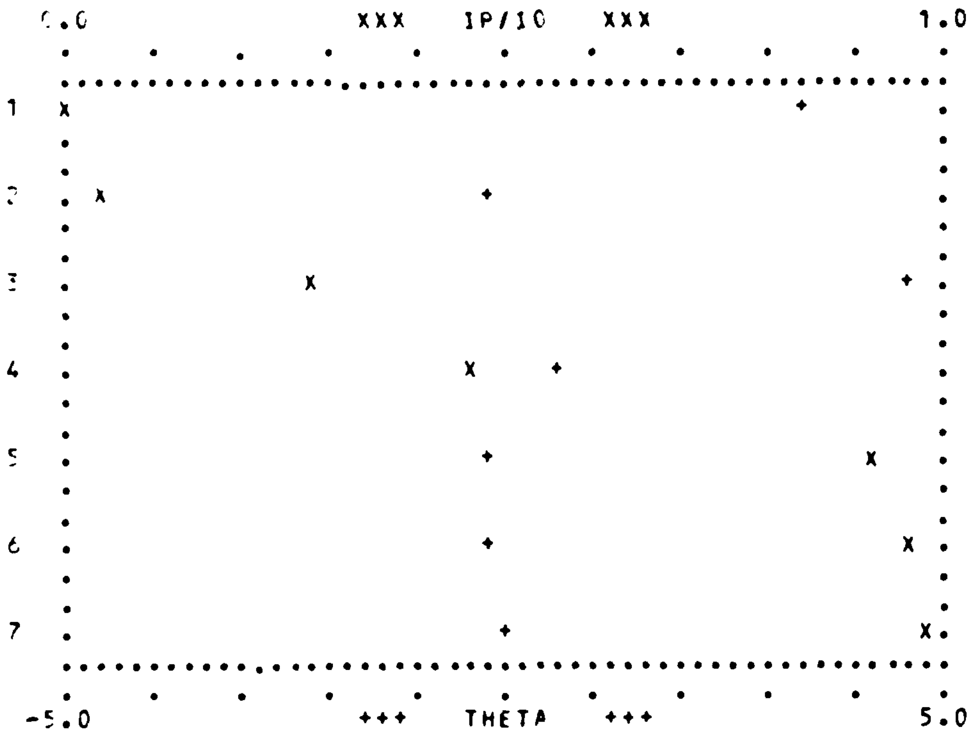

RUN 366. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=4.00002
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



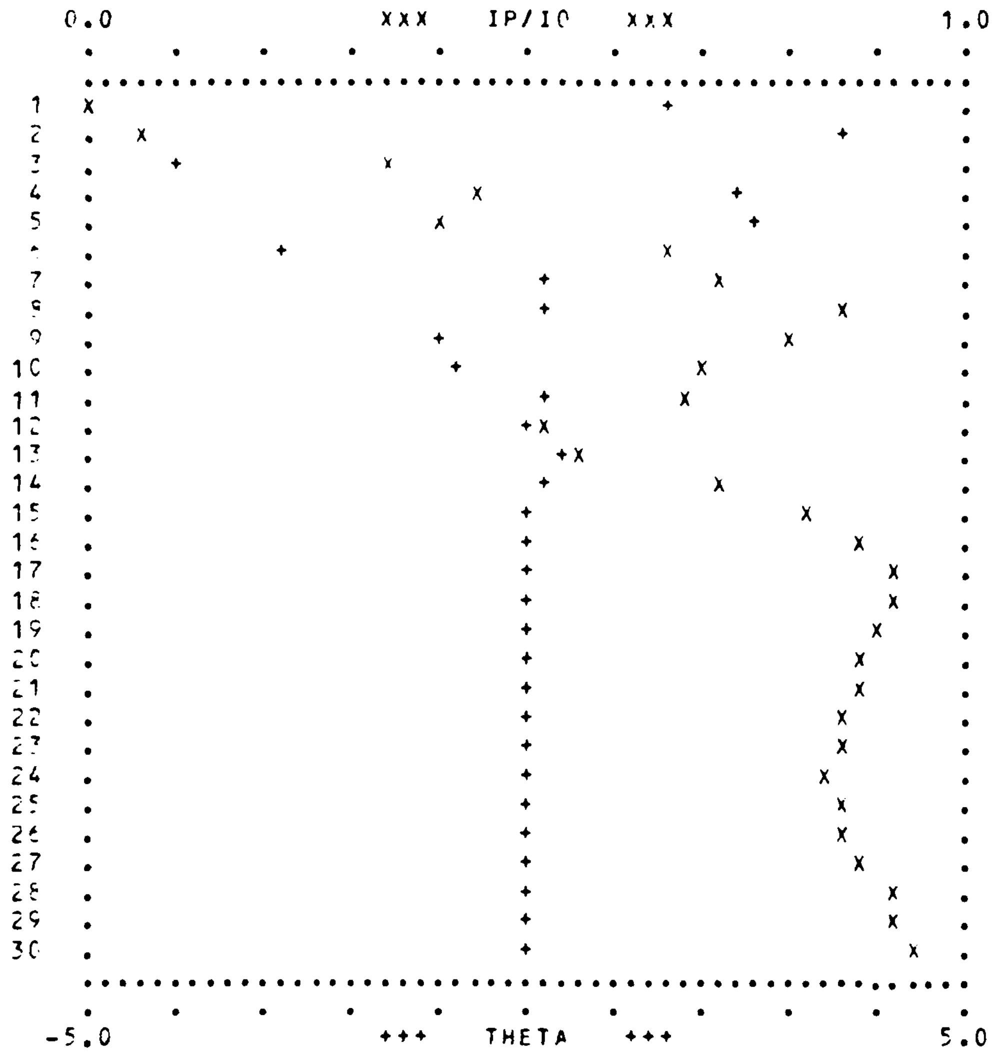

RUN 367. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



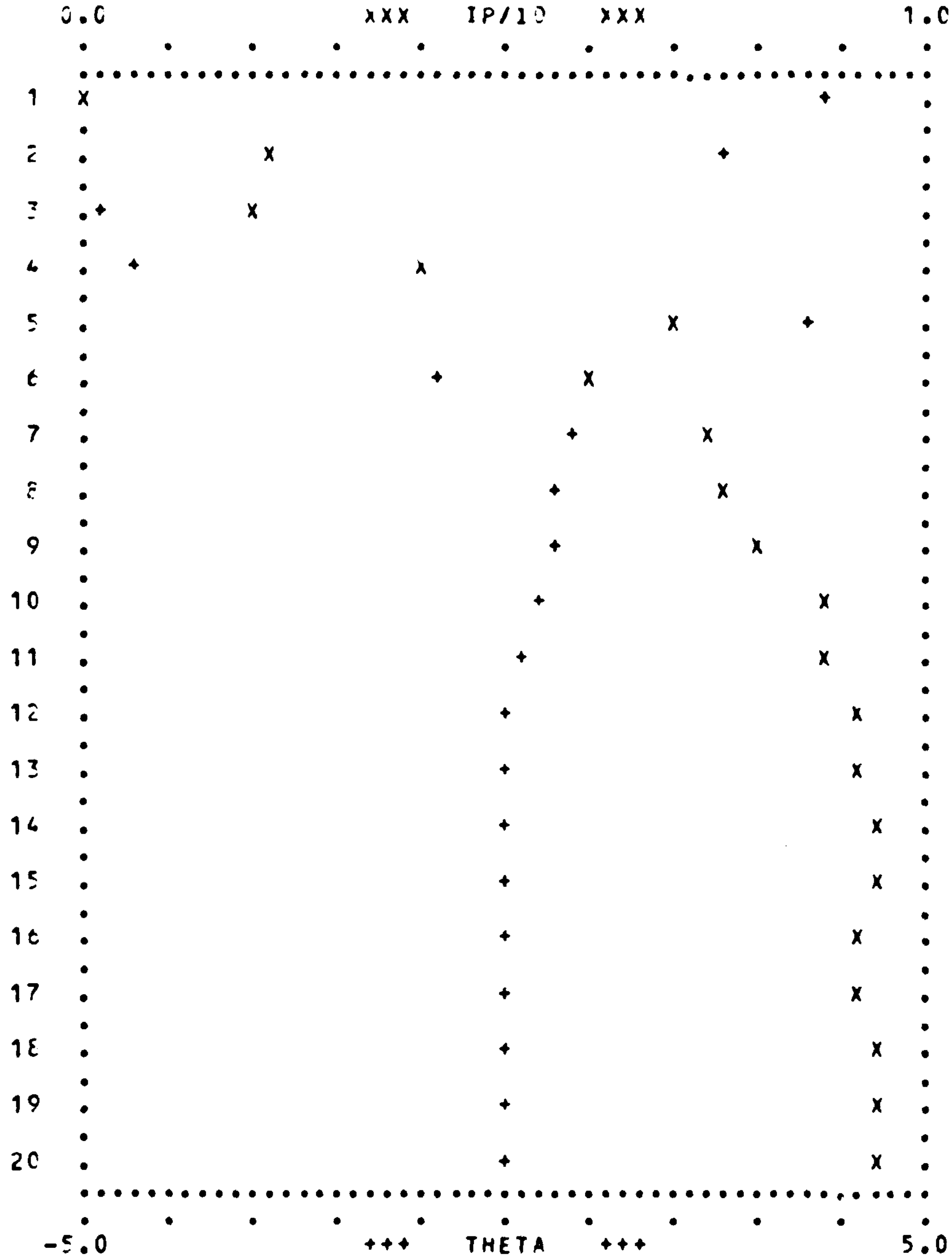

RUN 365. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



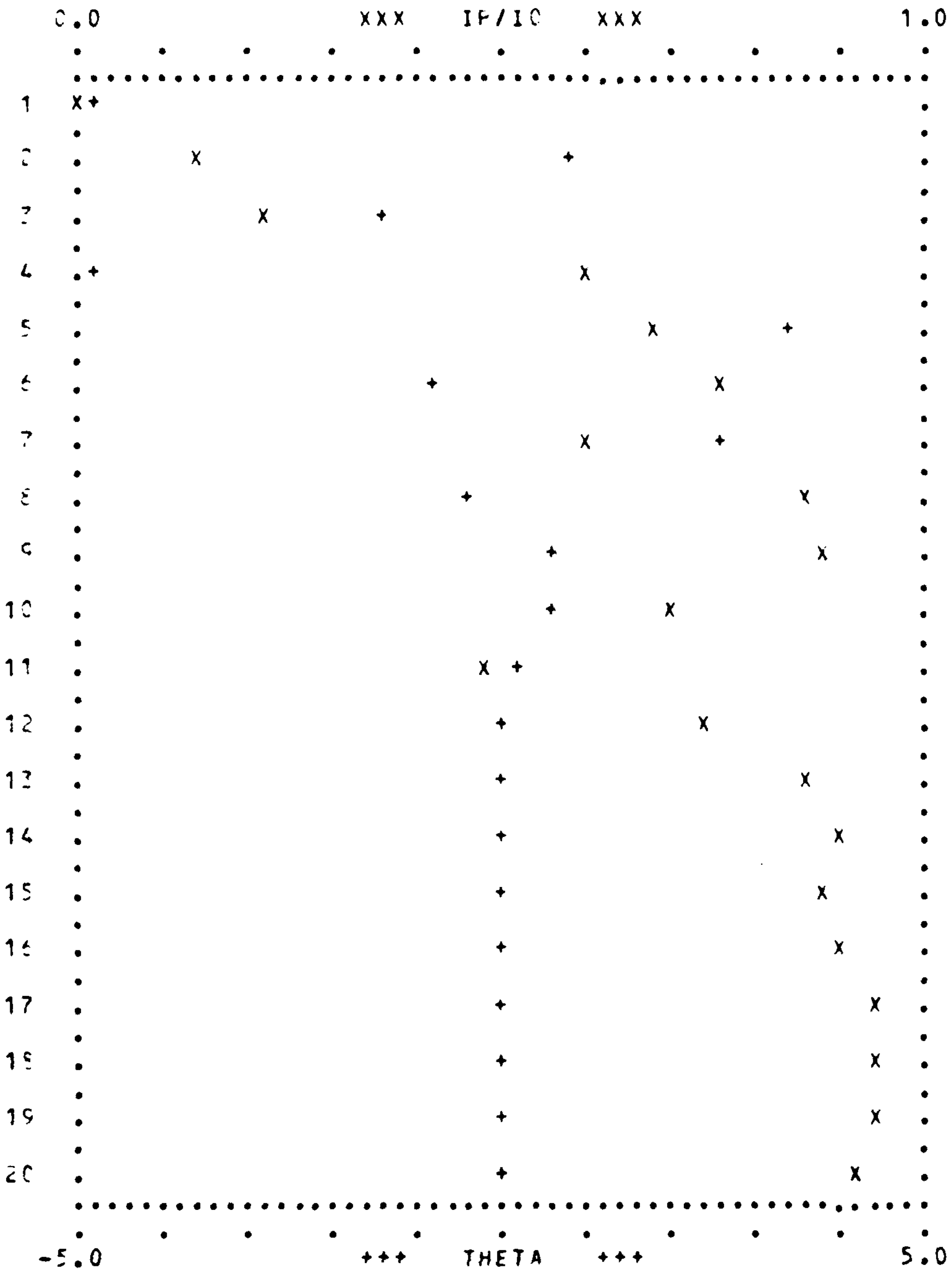

RUN 309. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=4.00002 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



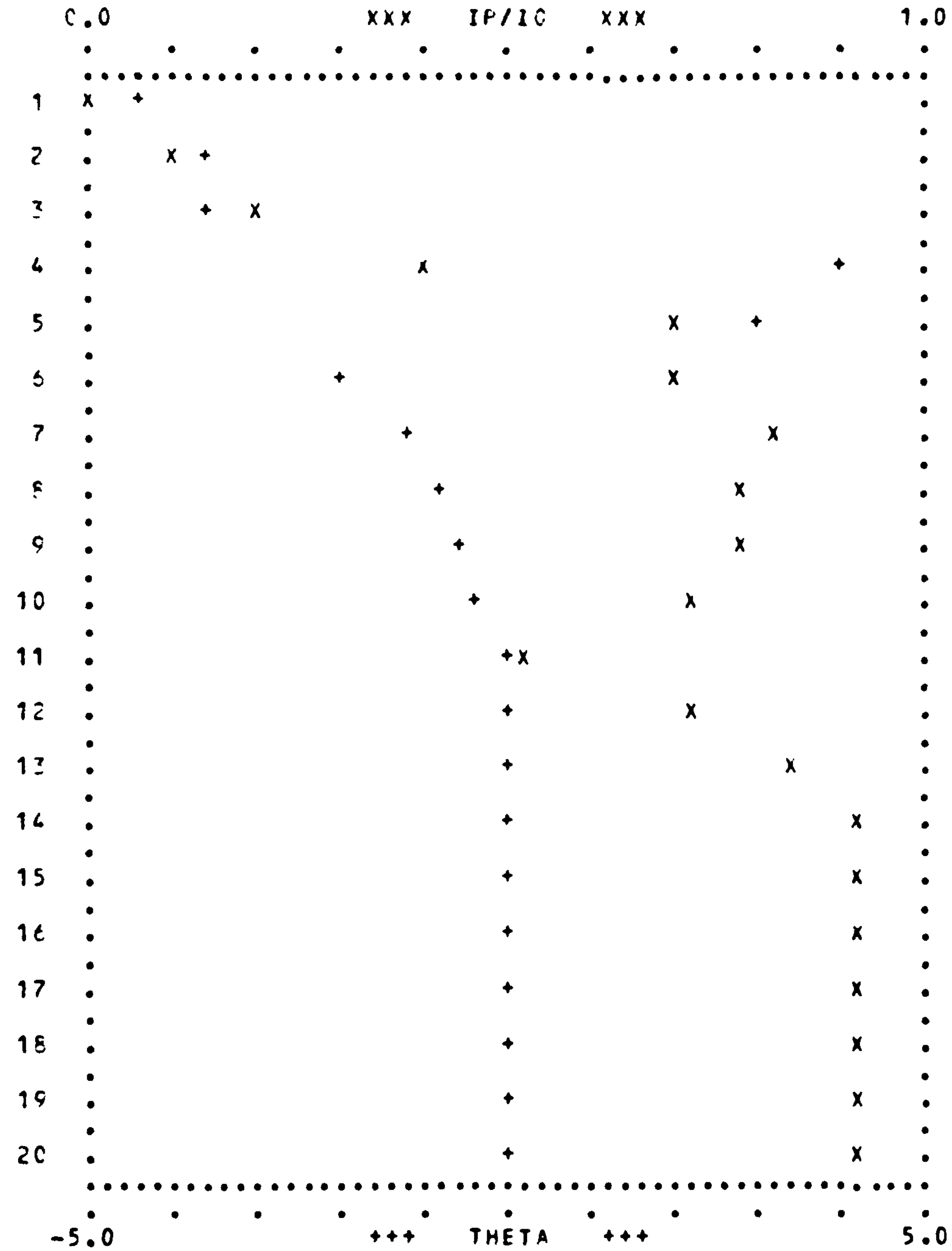

RUN 371. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



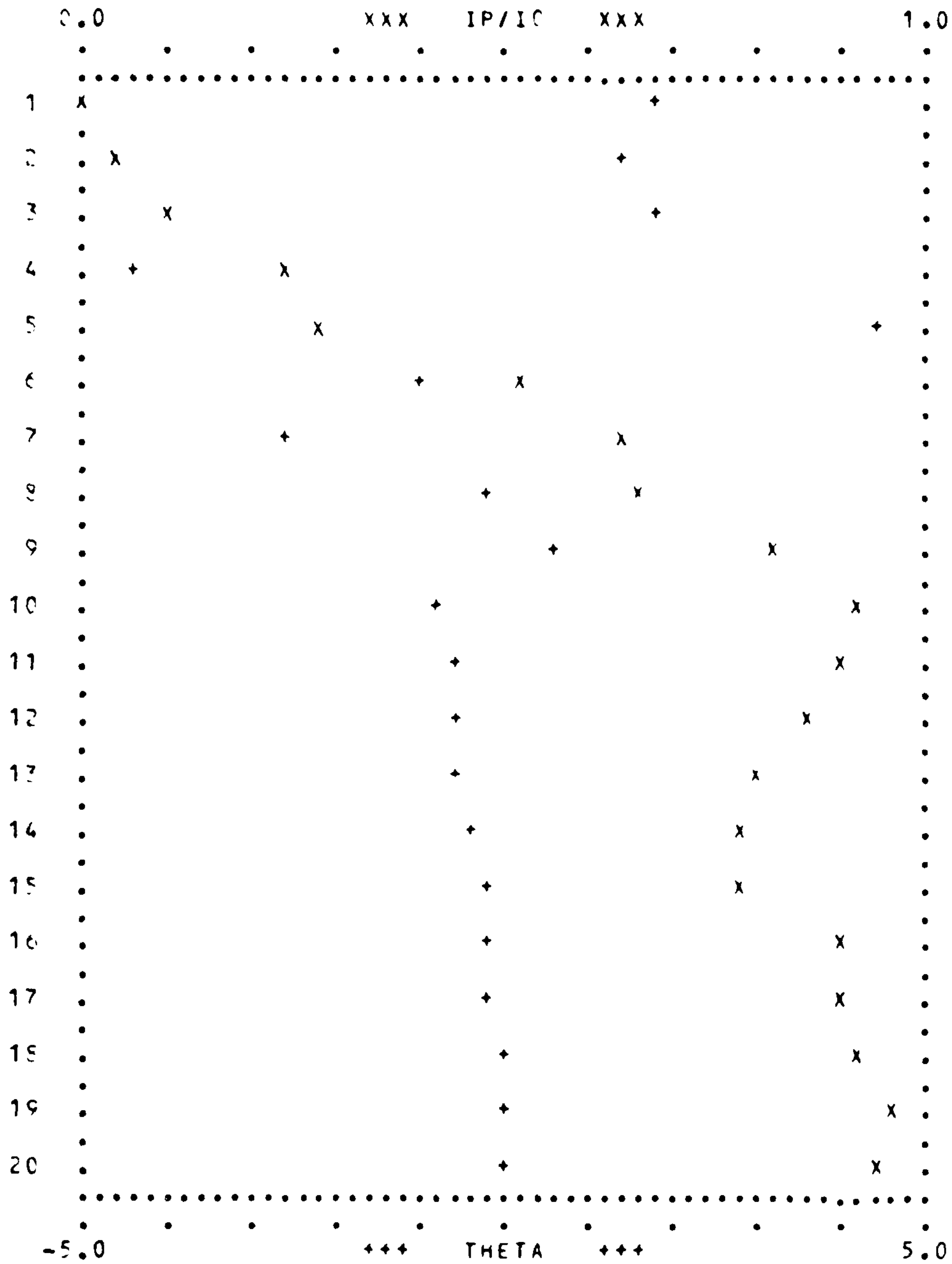

RUN 372. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.58740
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



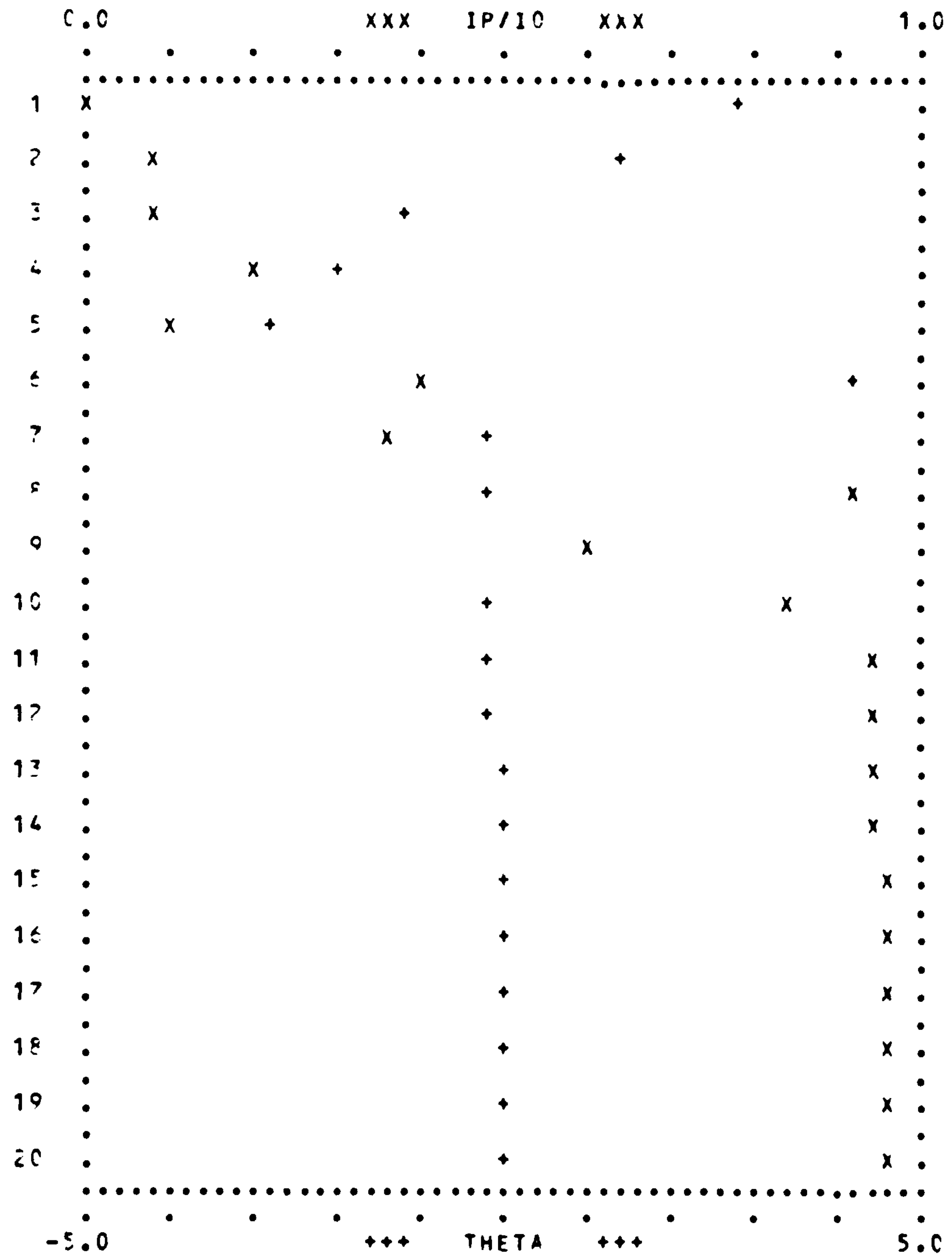

RUN 373. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.58740
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



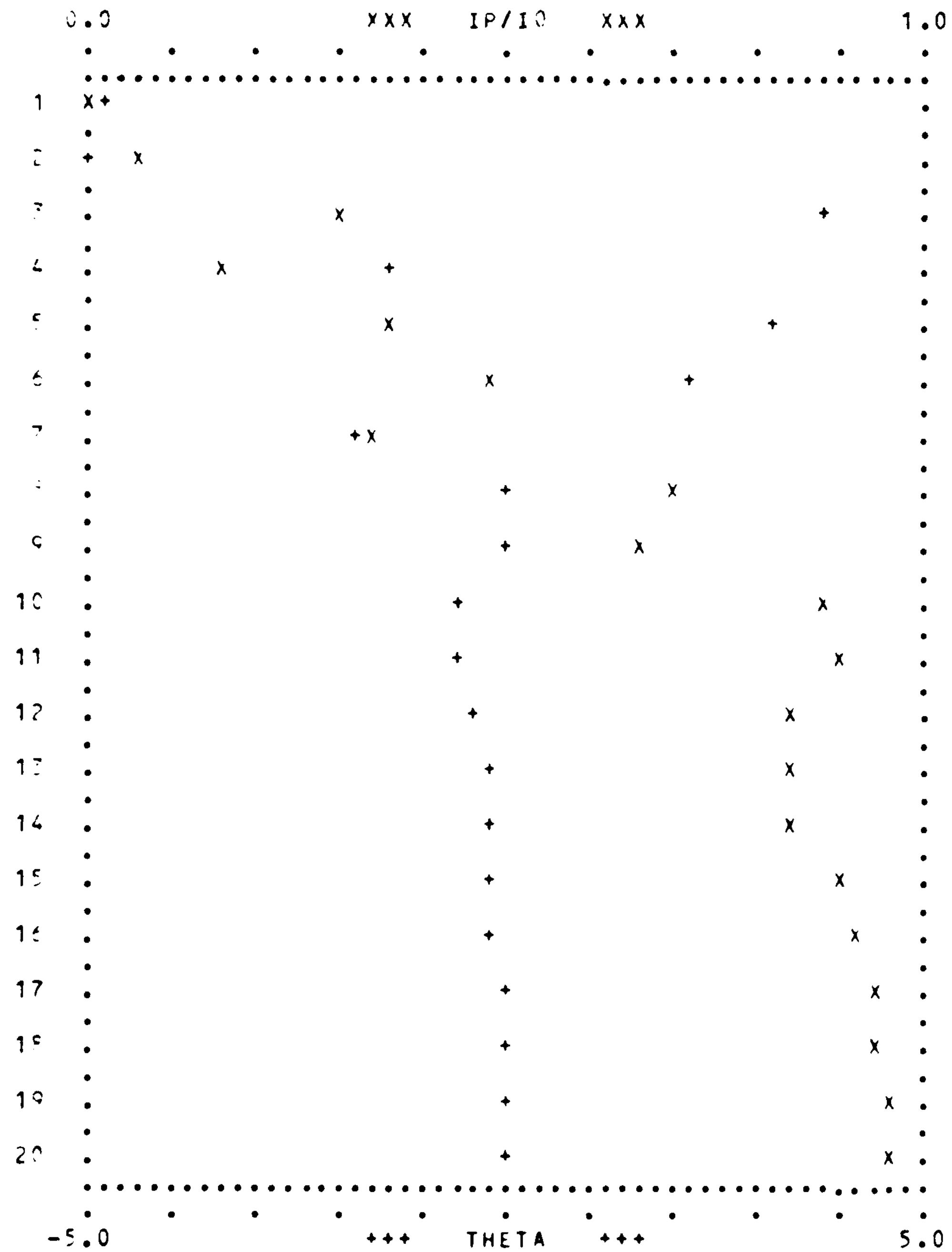

RUN 374. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



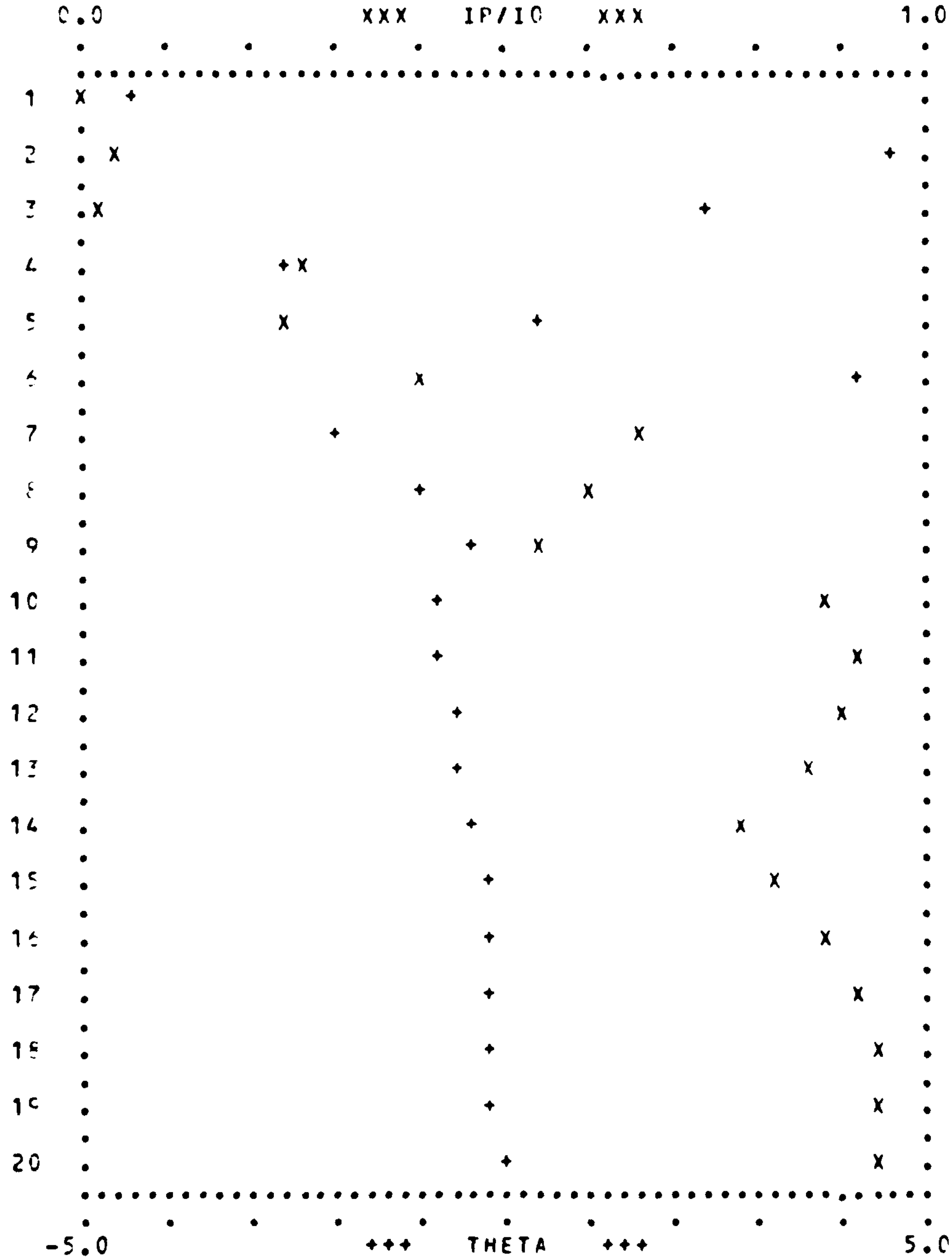

RUN 375. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.58740
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



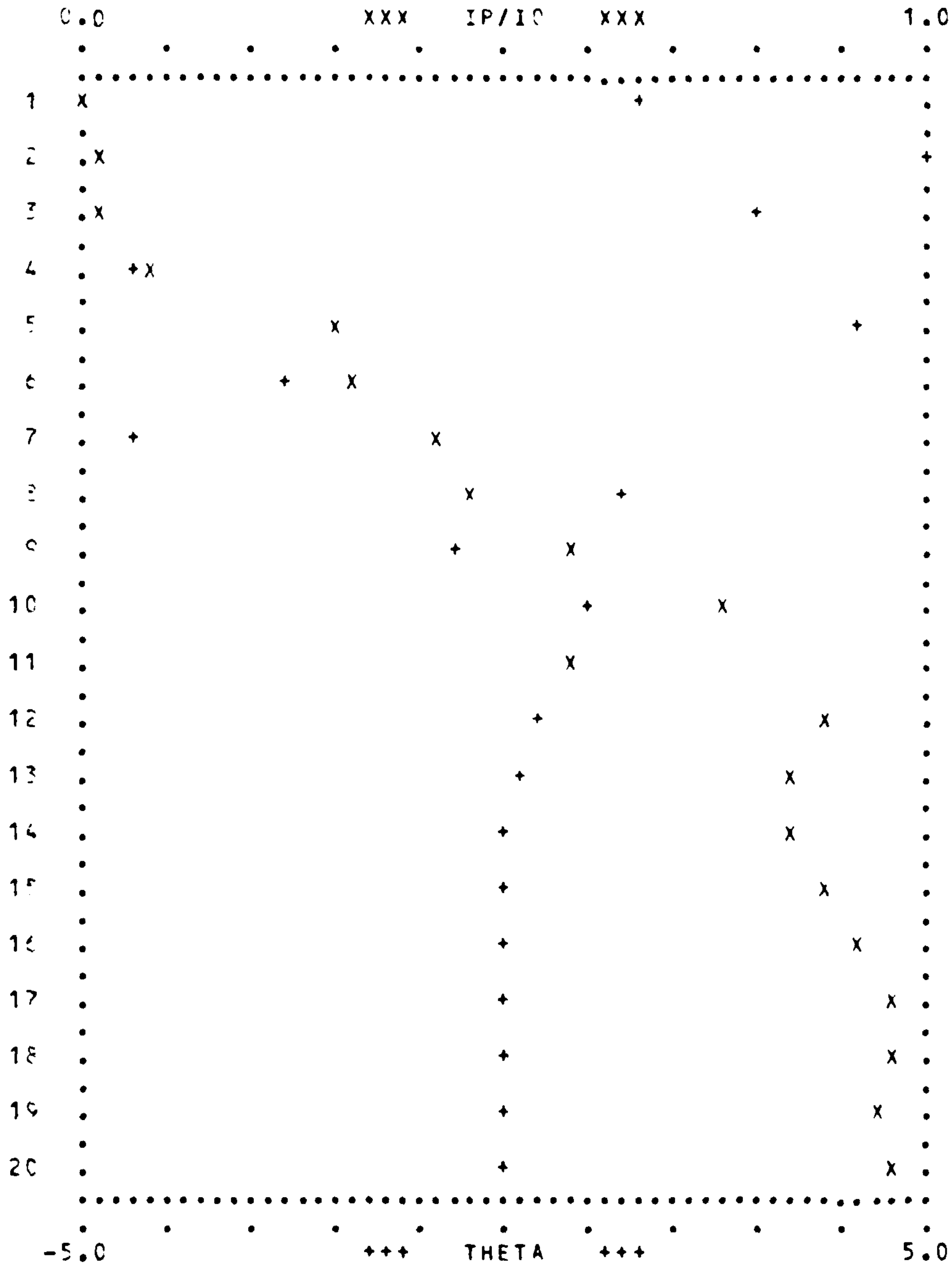

RUN 376. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



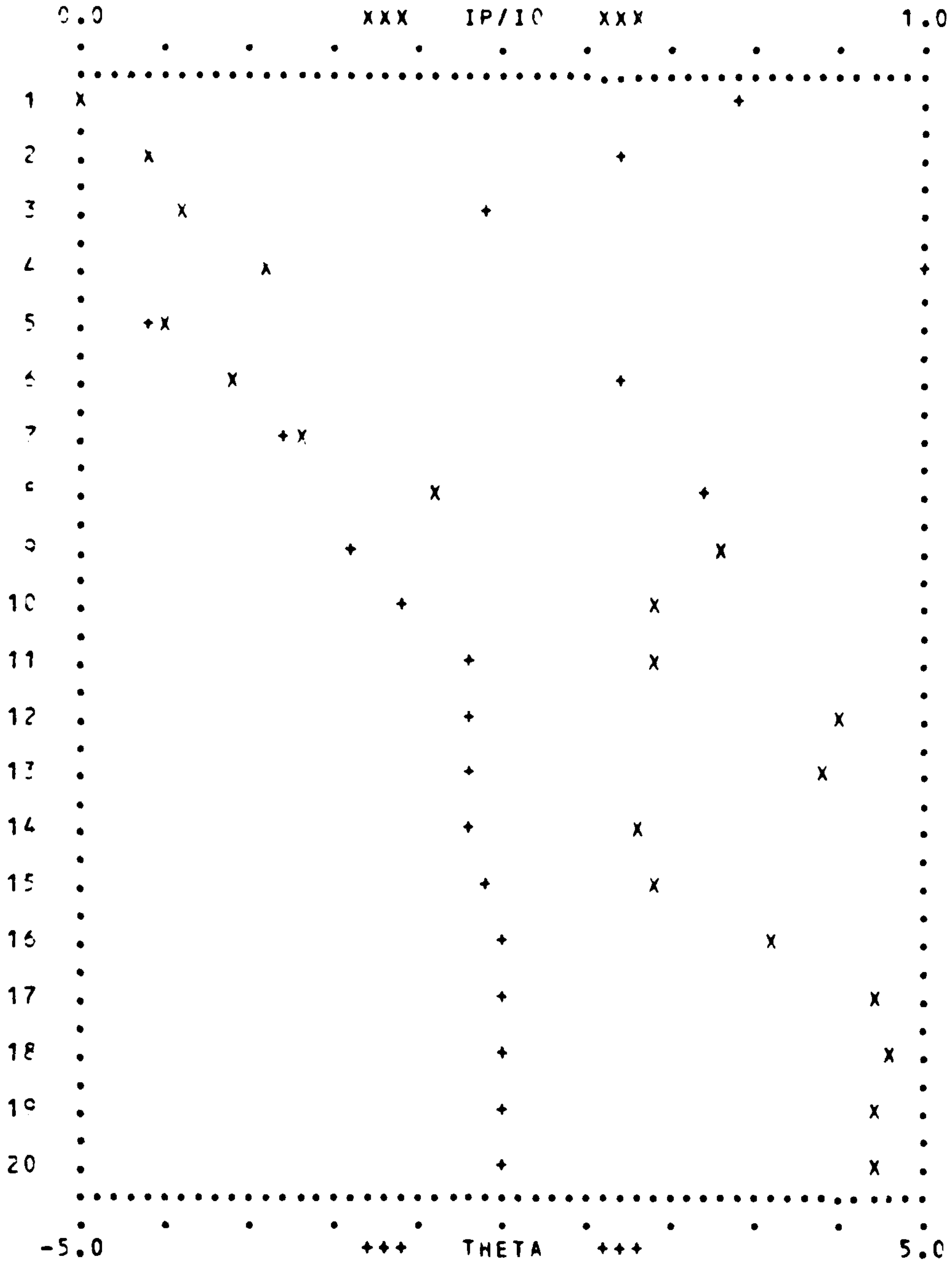

RUN 377. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



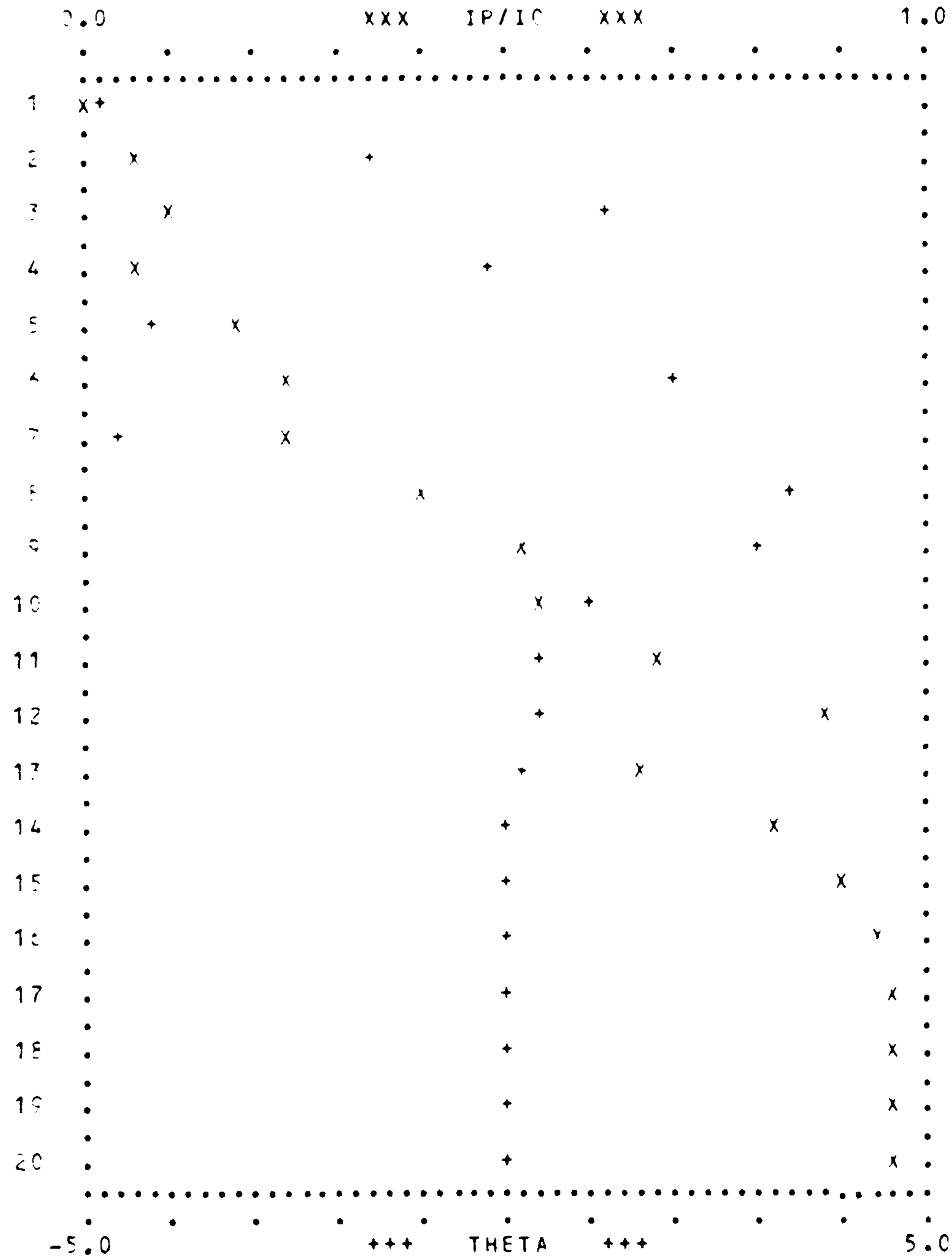

RUN 378. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



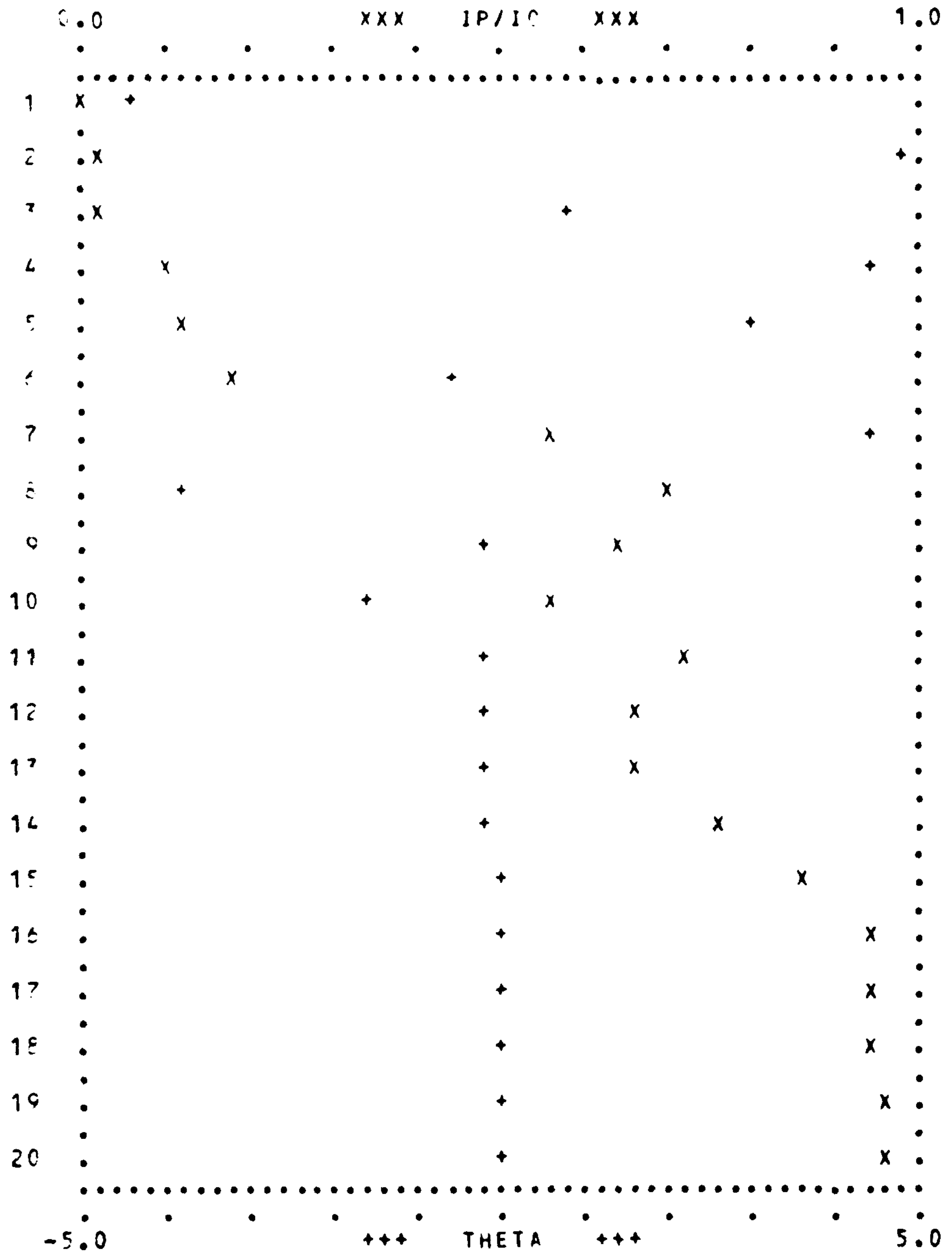

RUN 379. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.58740
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



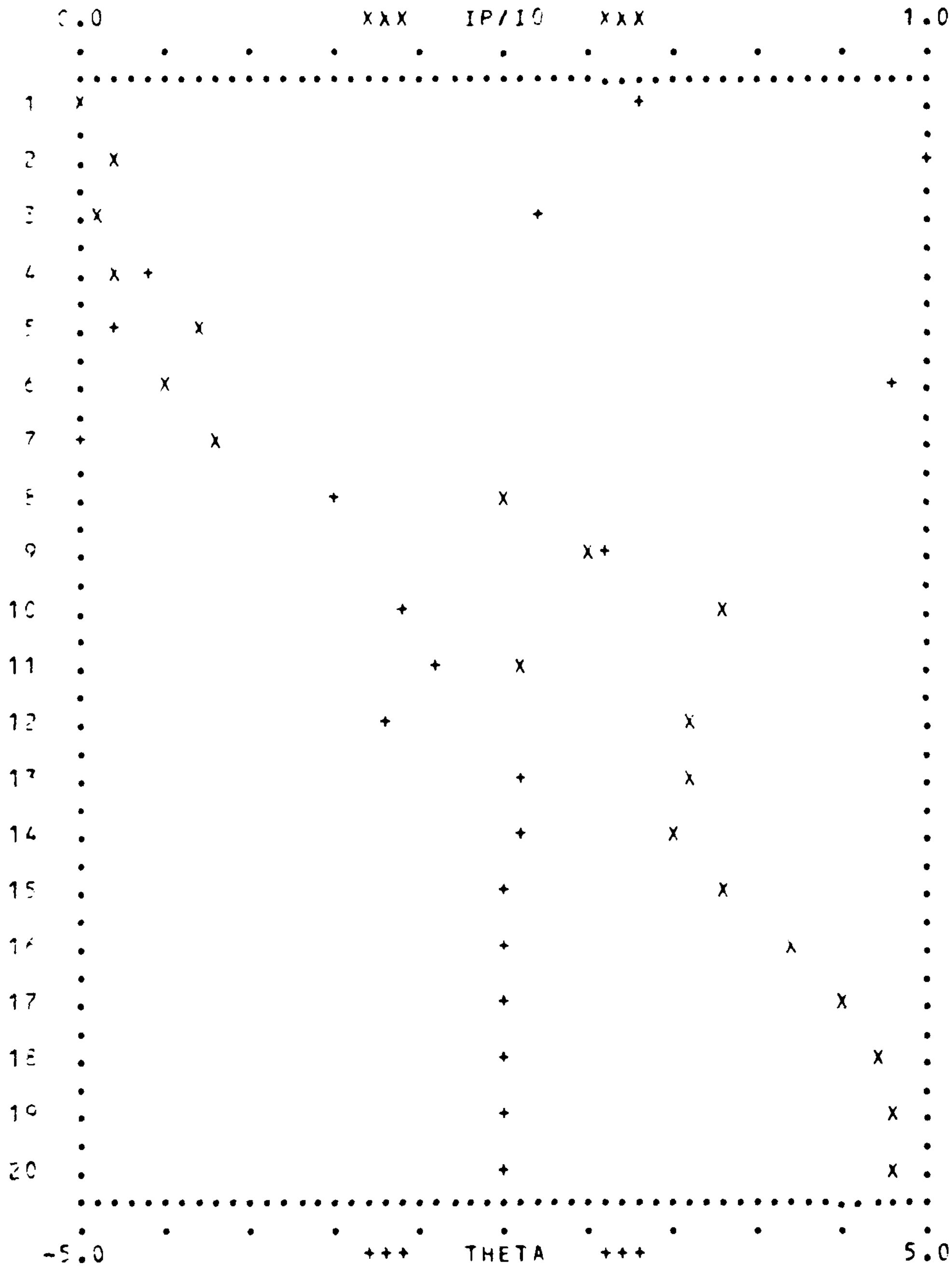

RUN 380. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



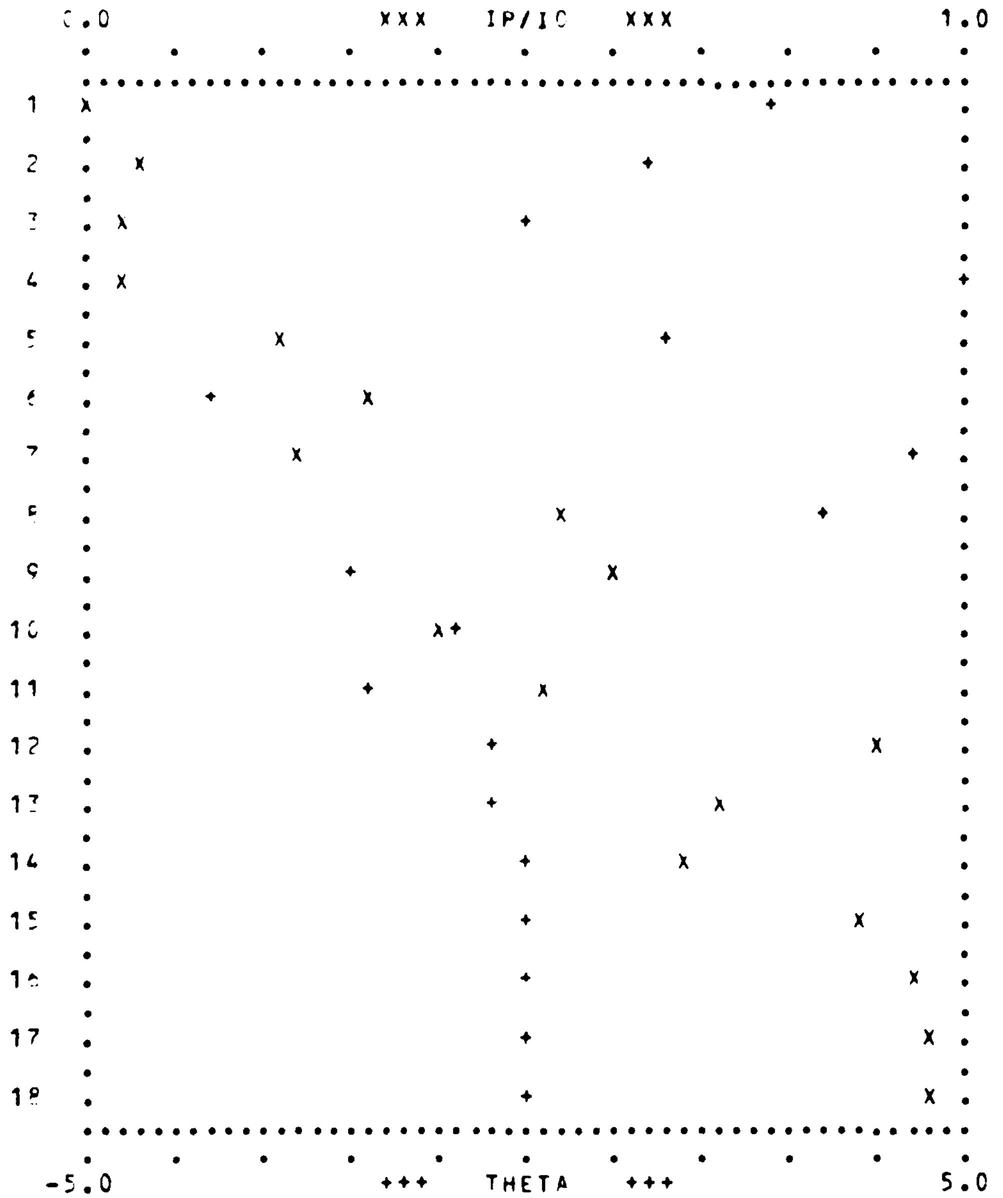

RUN 351. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



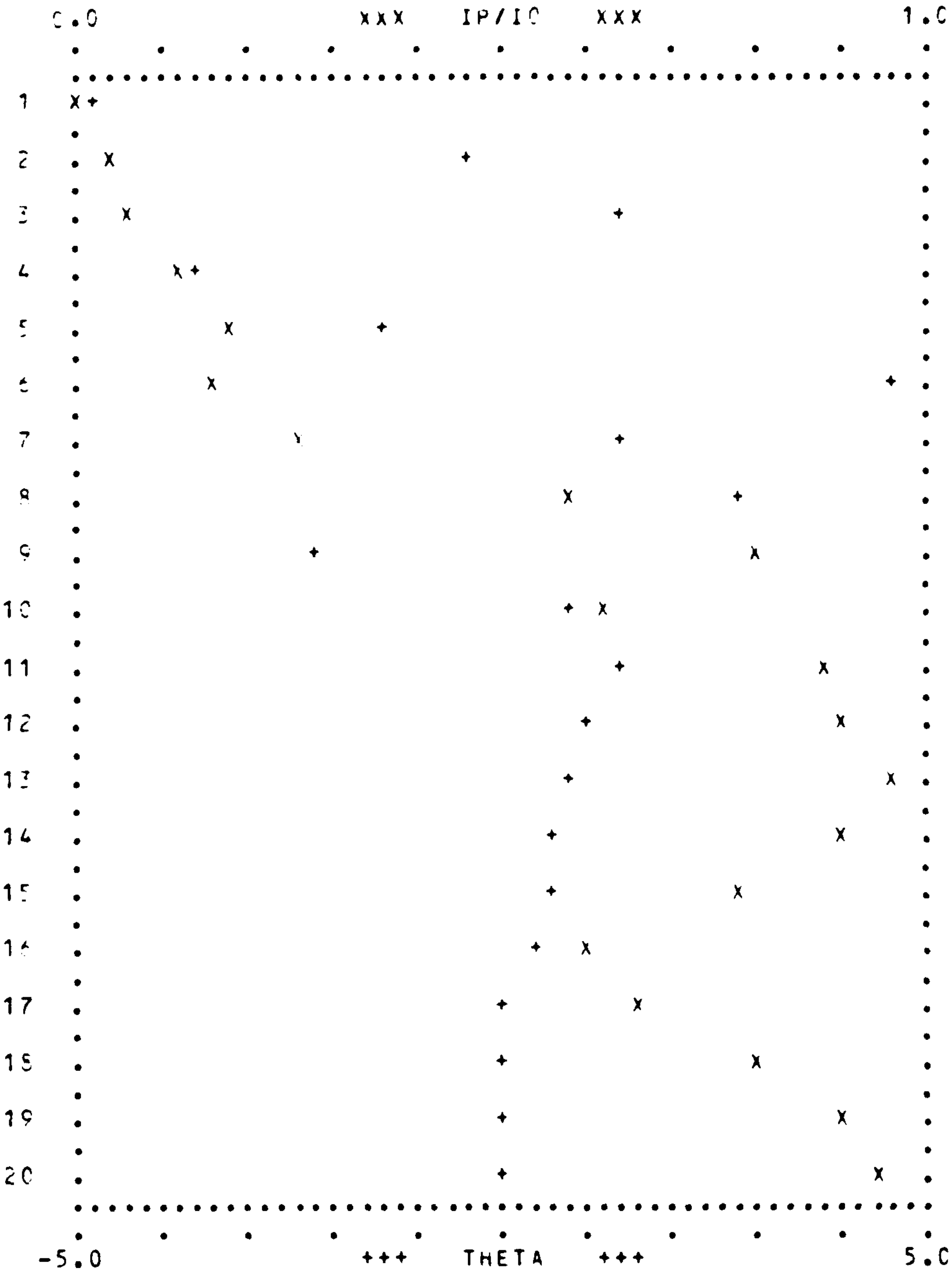

RUN 382. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



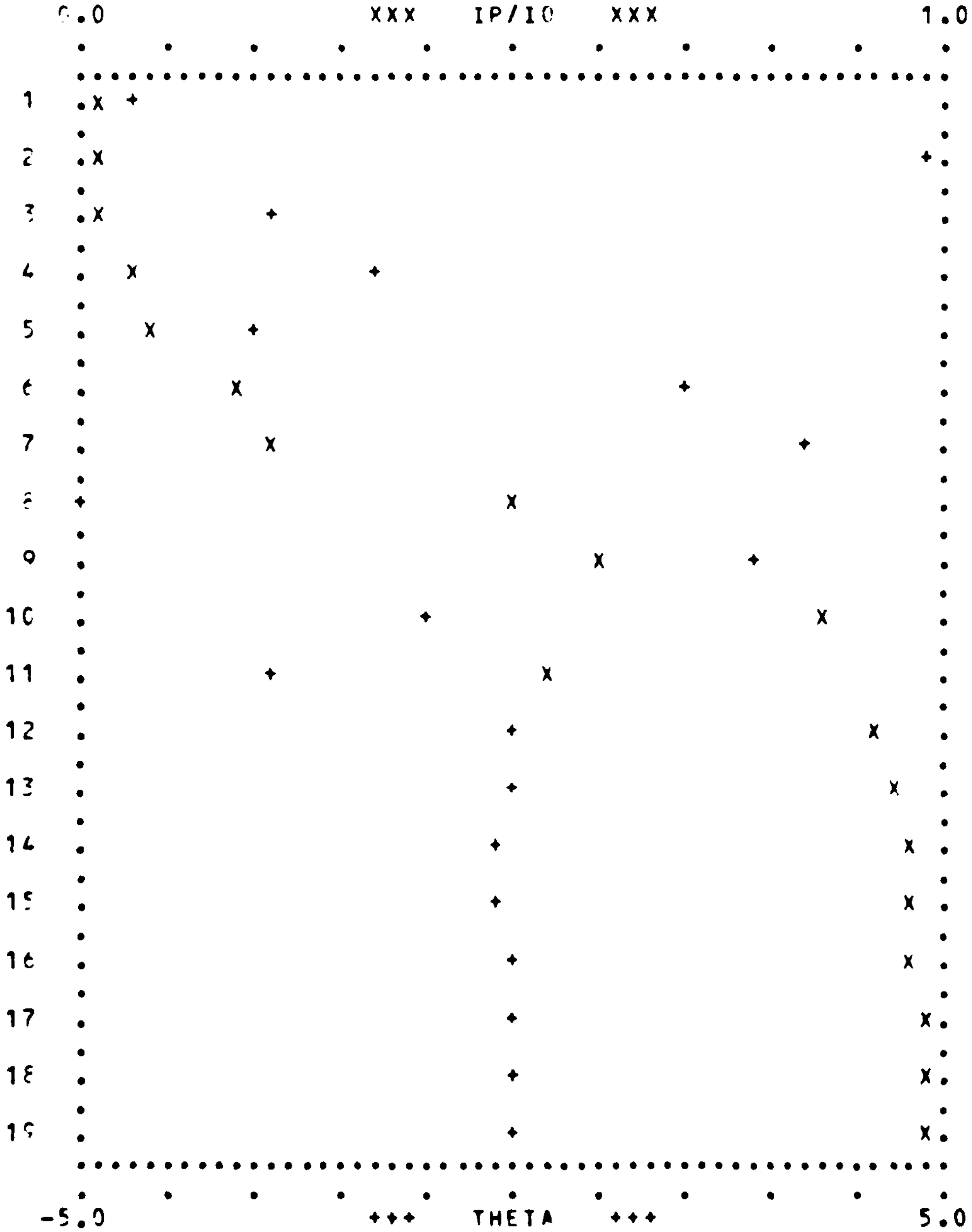

RUN 383. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.58740
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



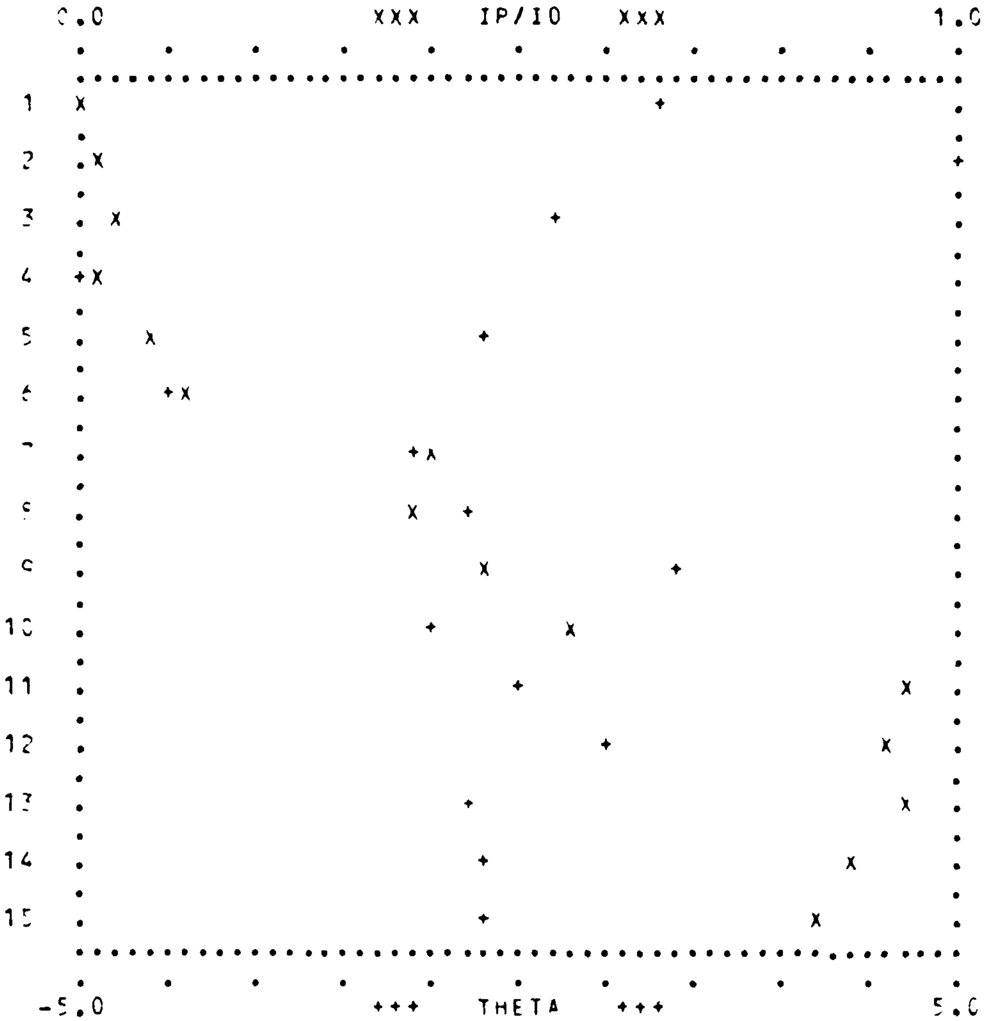

RUN 384. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.58740
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



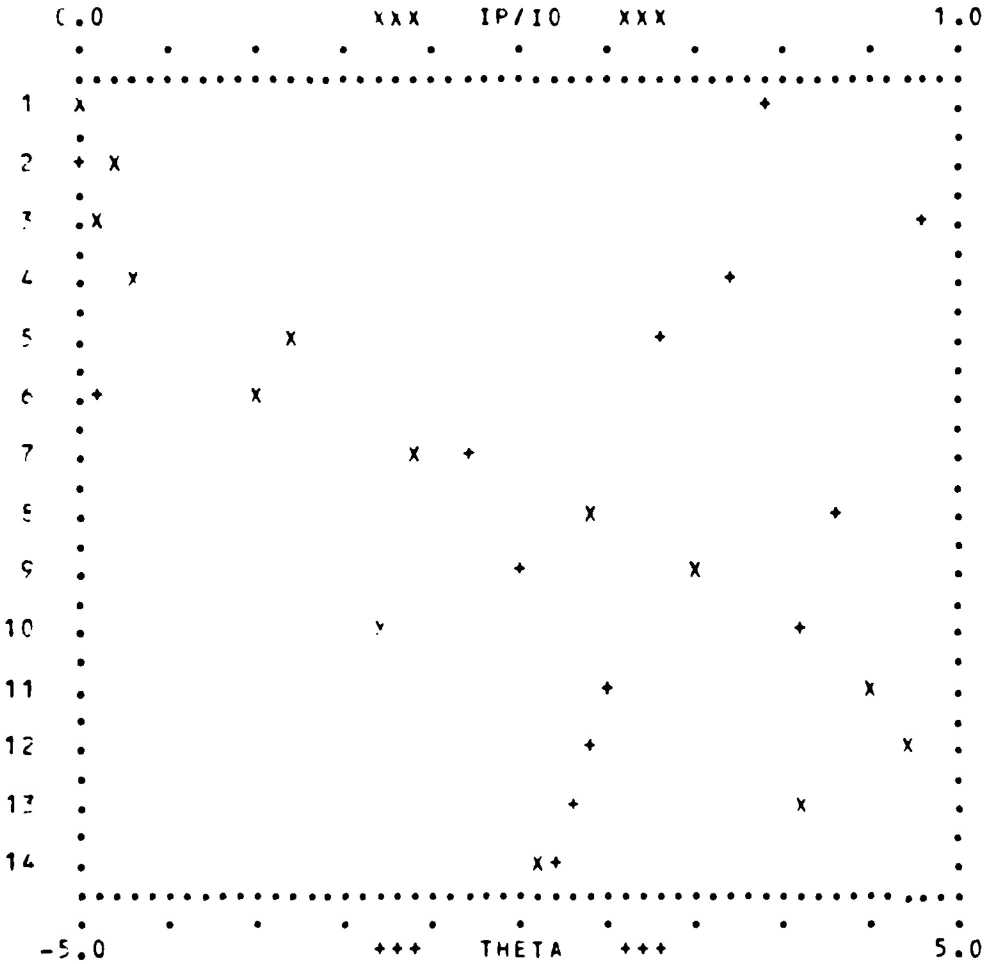

RUN 385. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



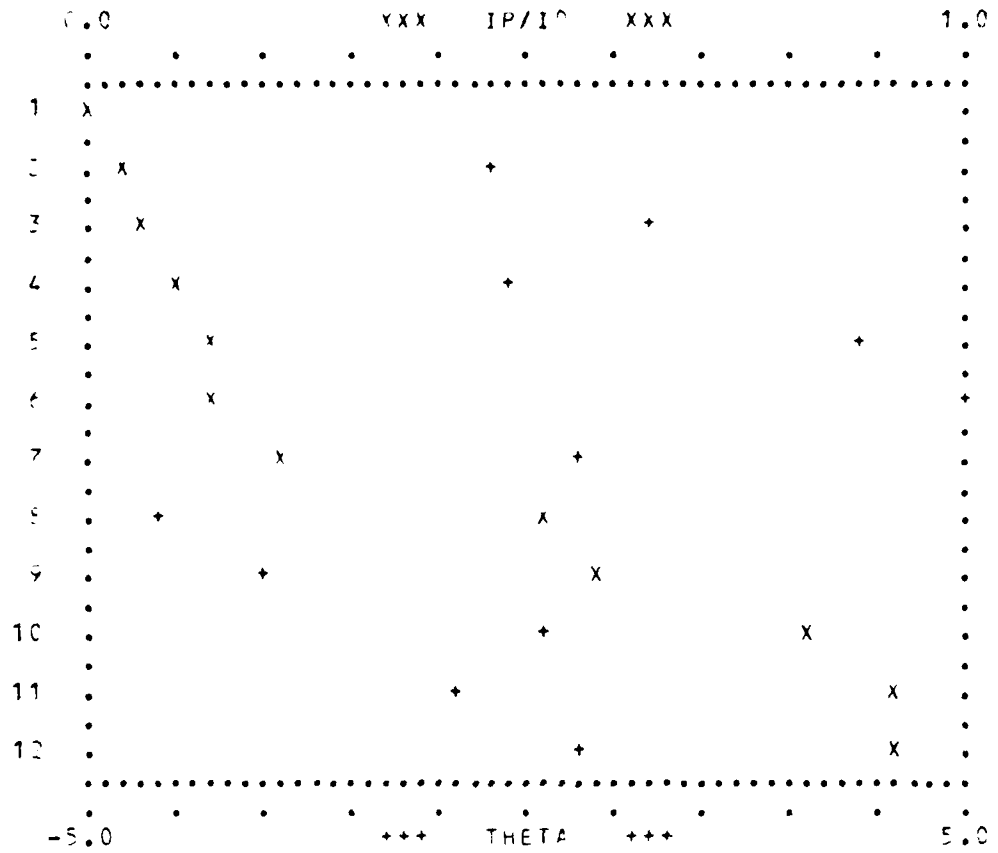

RUN 385. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



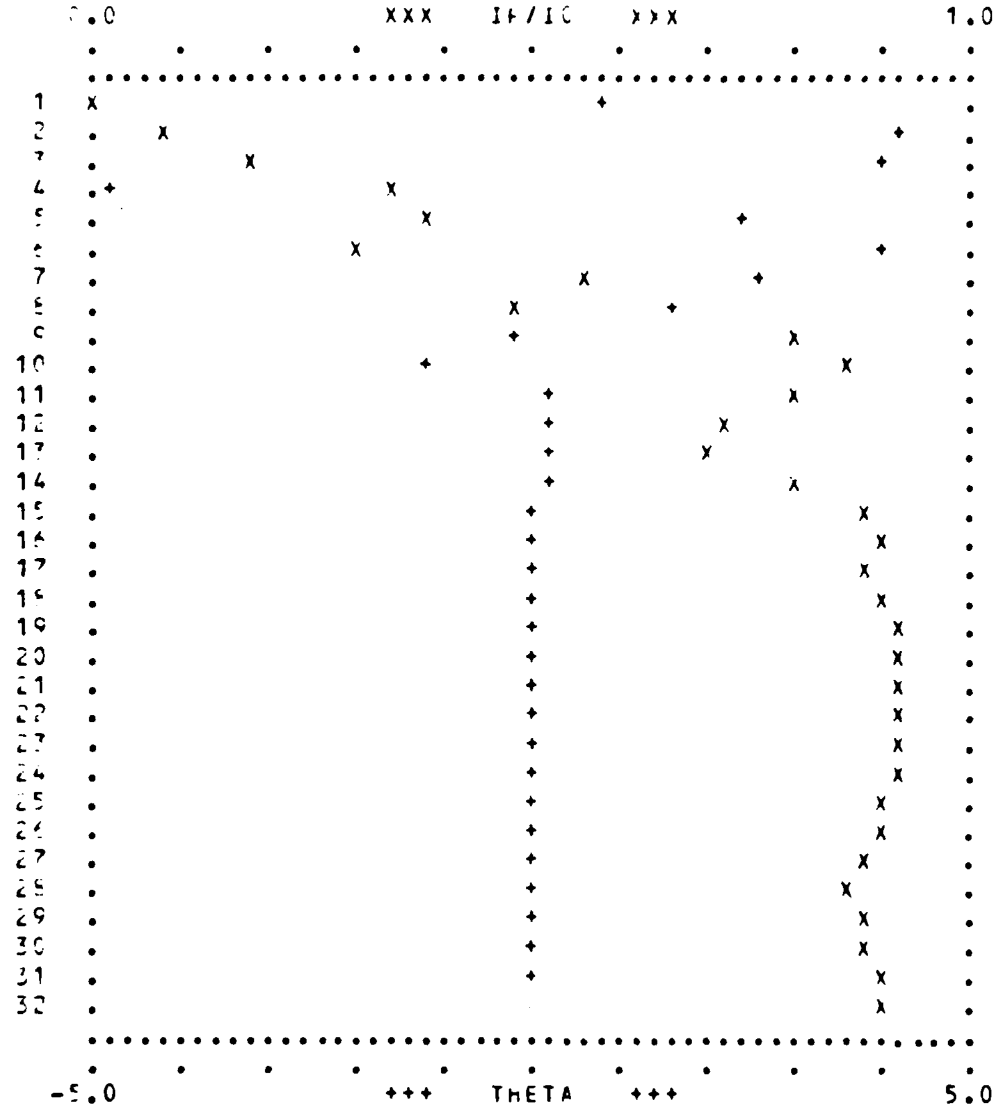

RUN 327. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



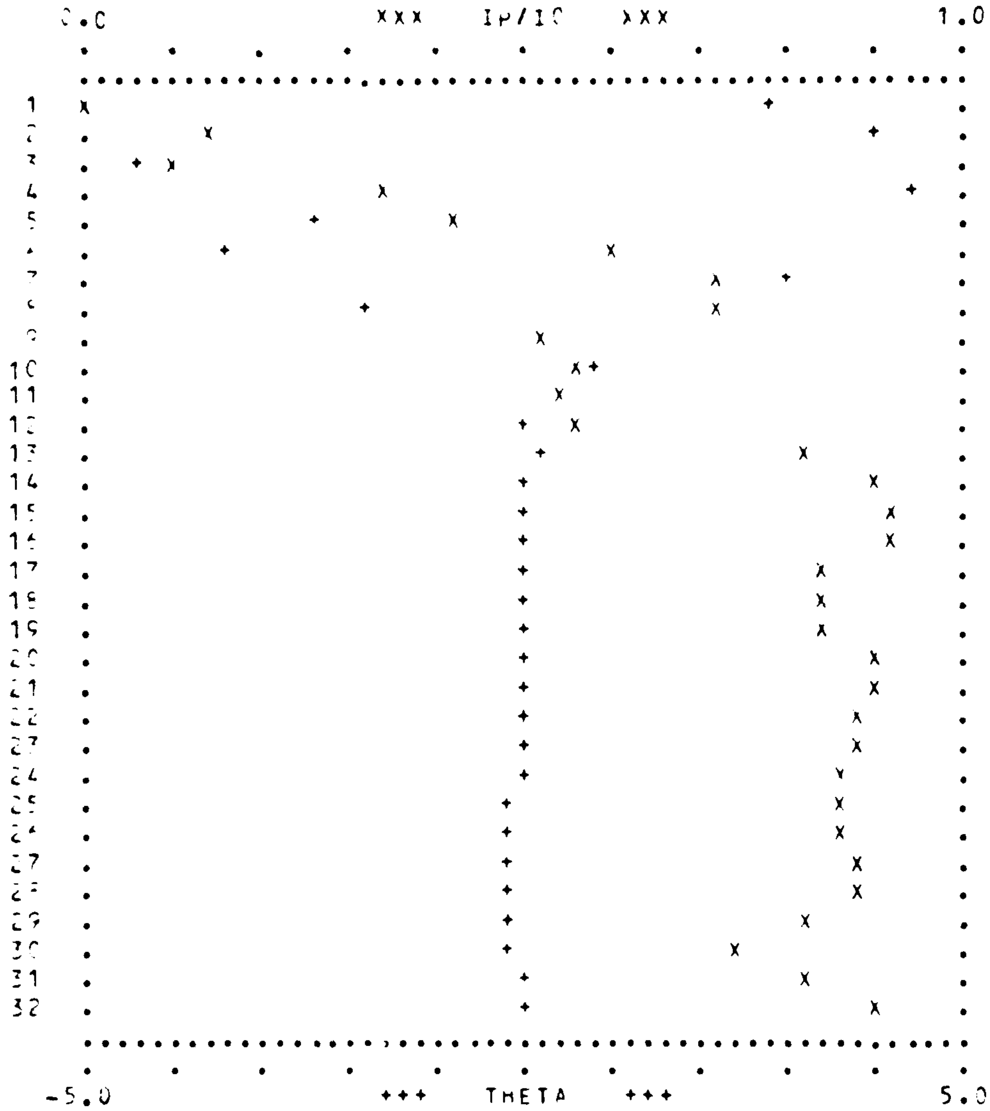

RUN 368. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=1.58740
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



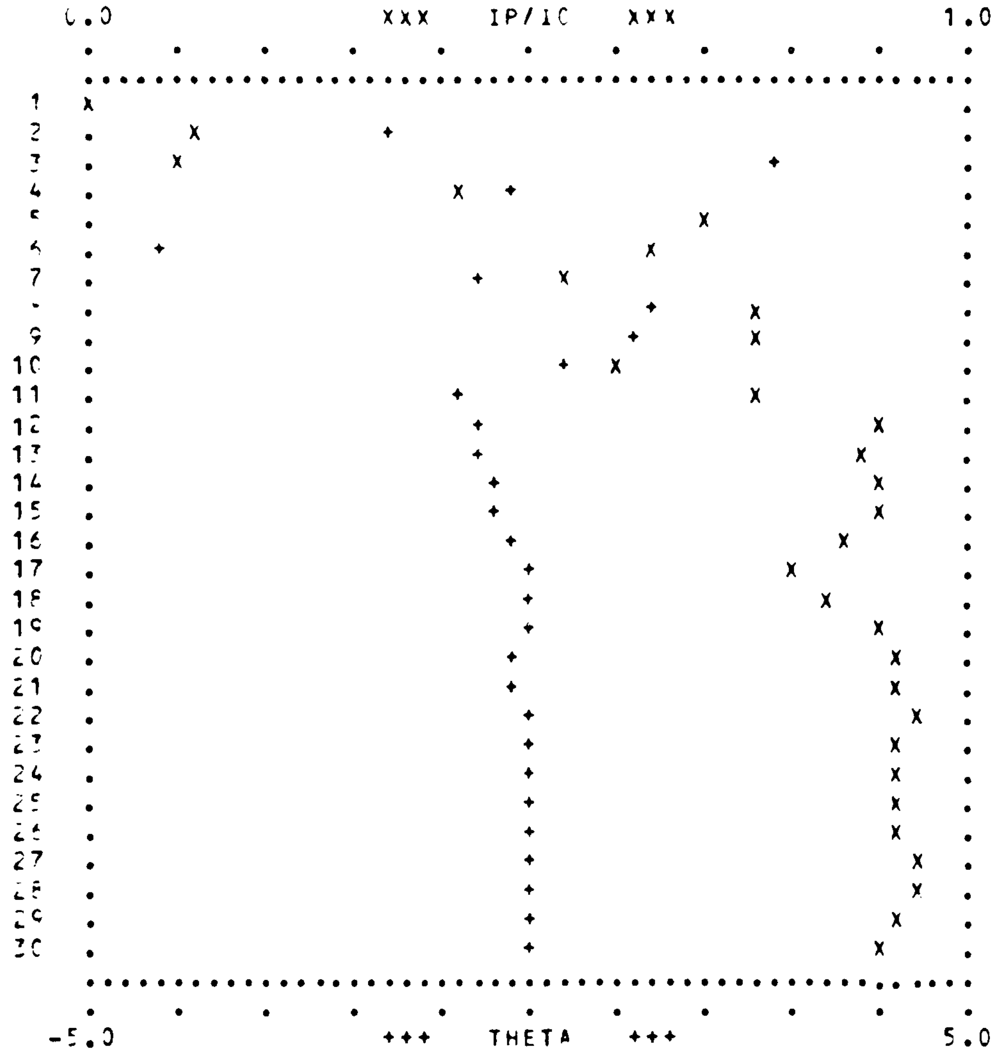

RUN 369. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=1.58740 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



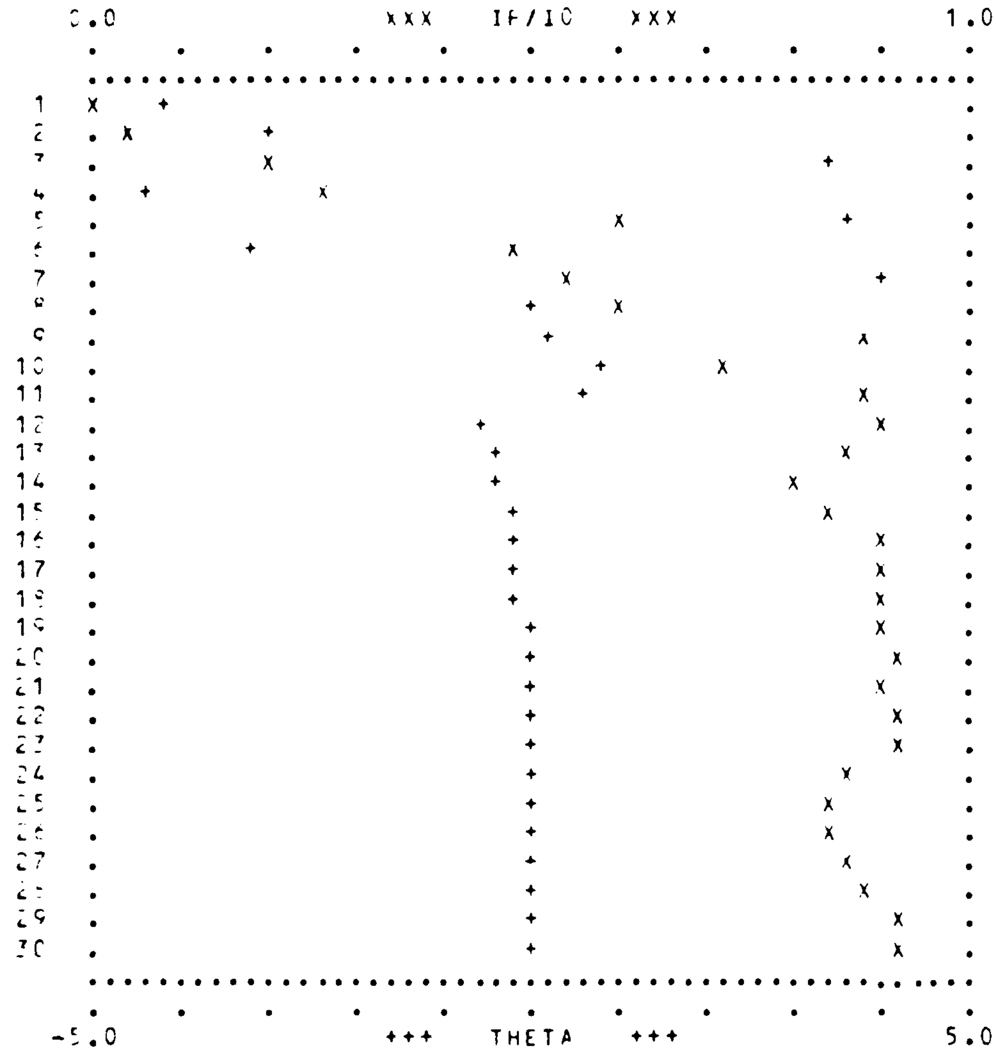

RUN 391. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



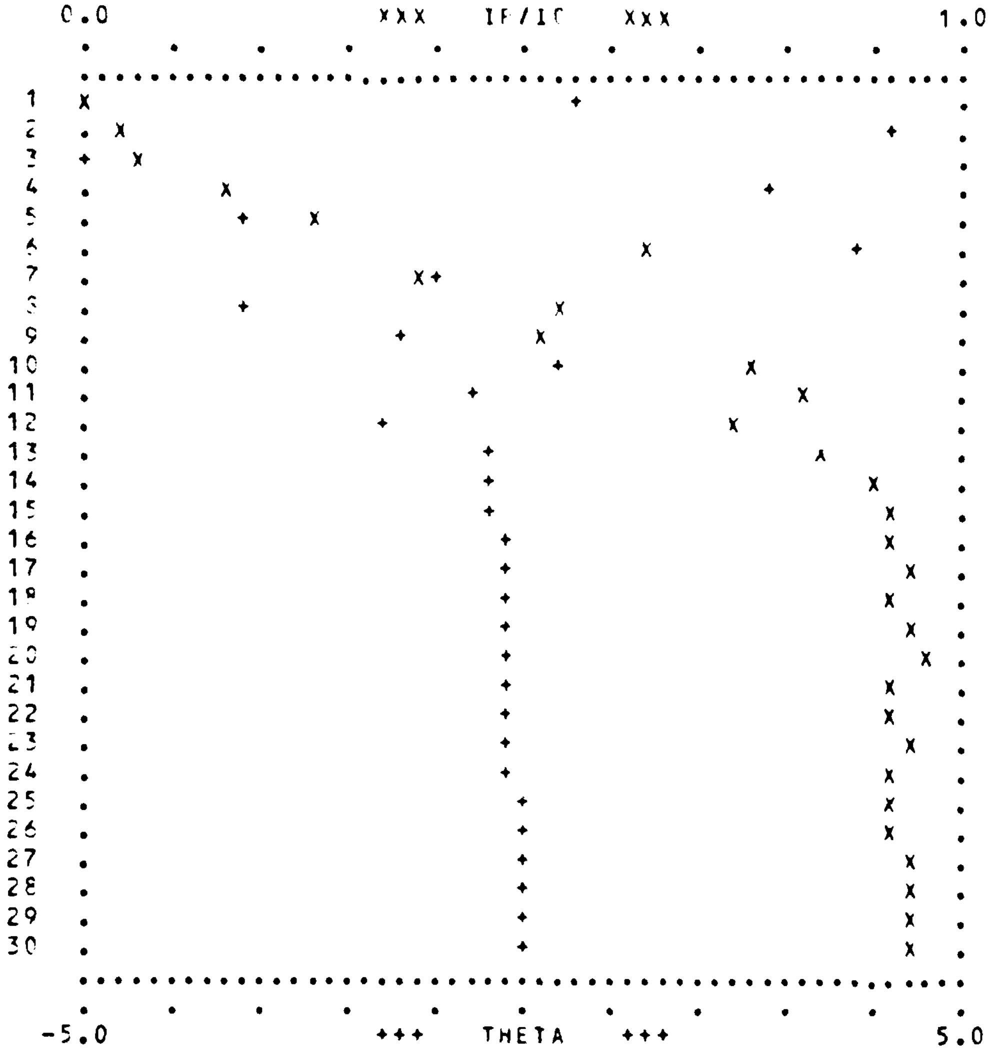

RUN 392. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



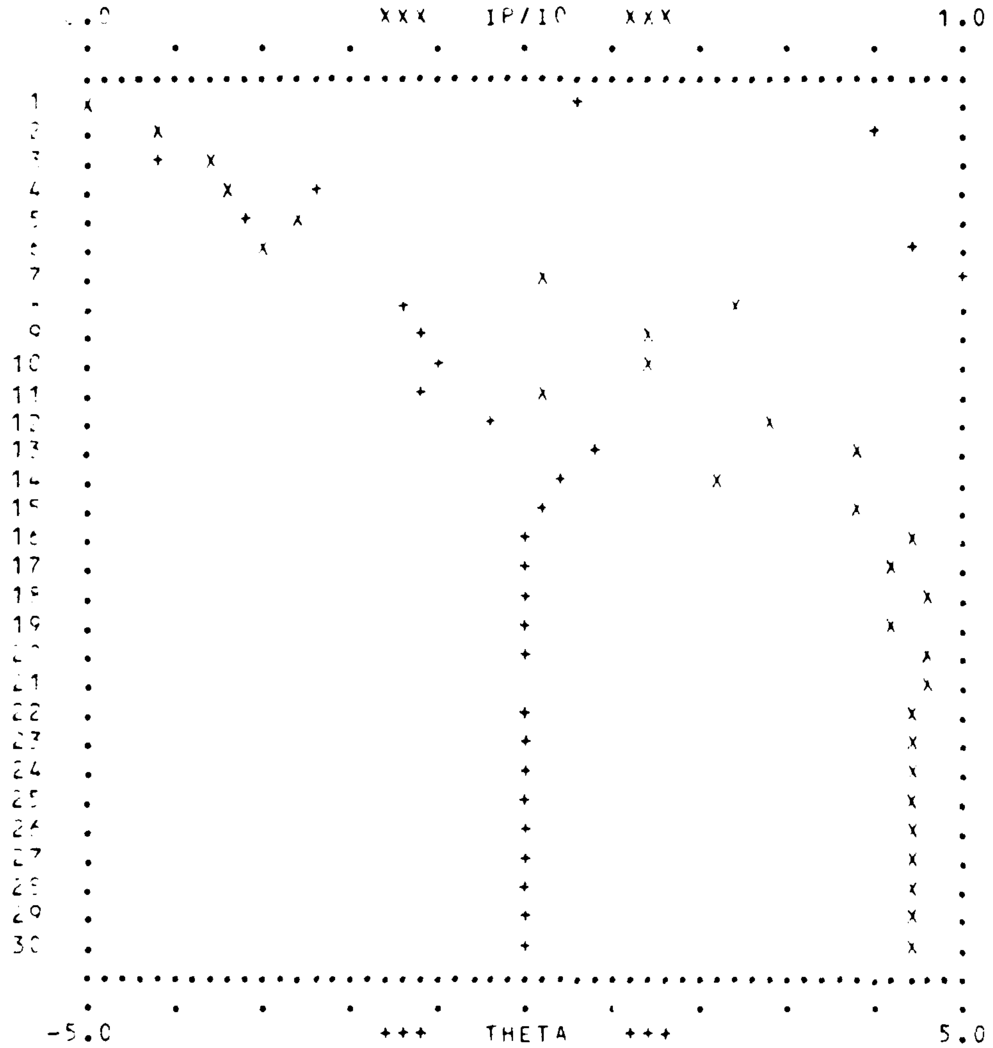

RUN 393. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



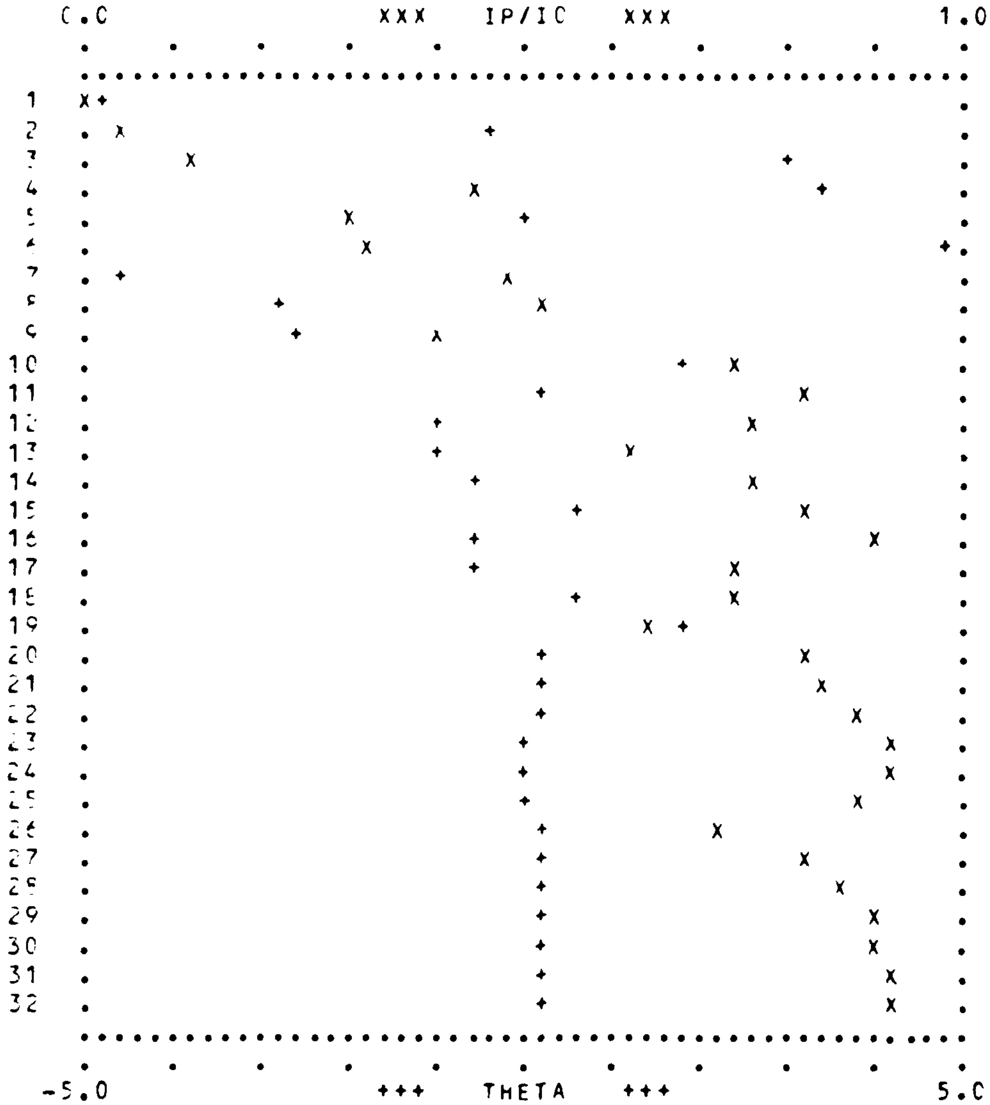

RUN 394. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



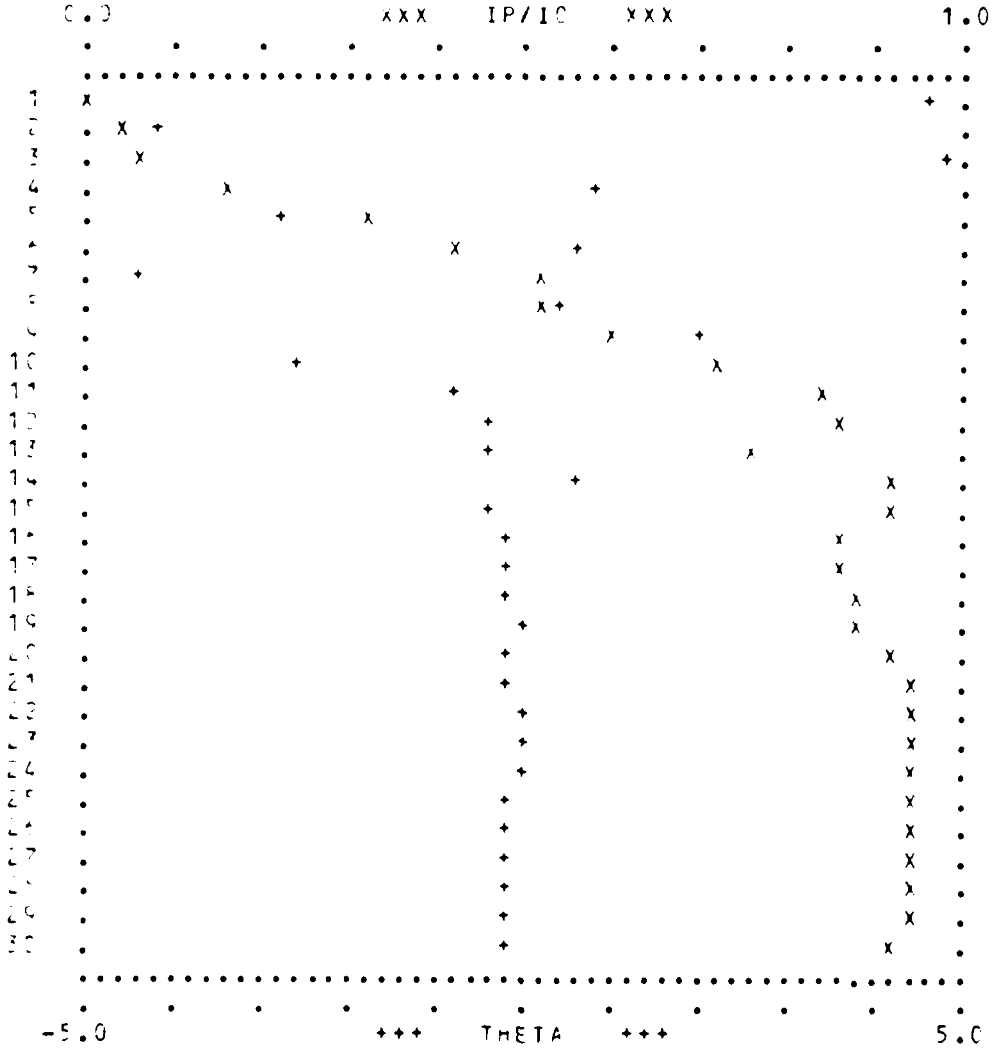

RUN 395. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



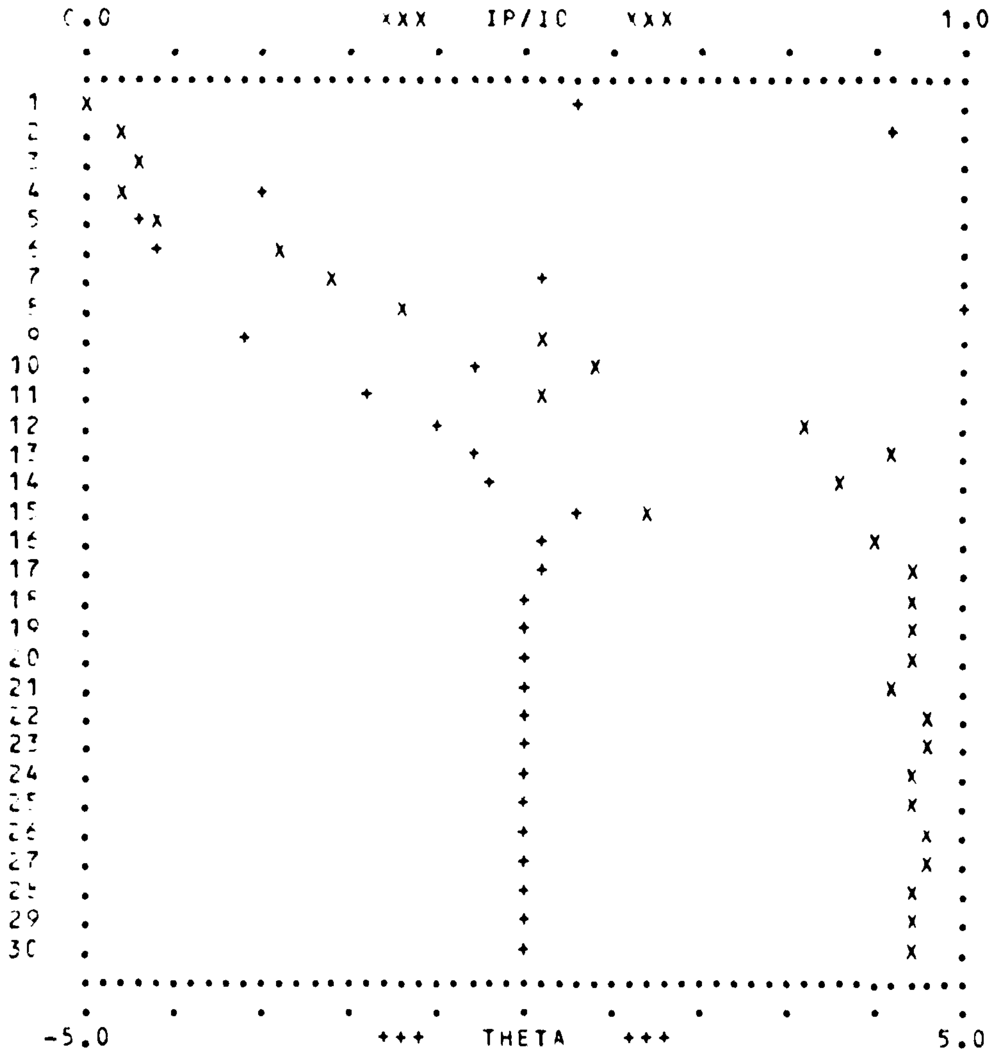

RUN 396. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



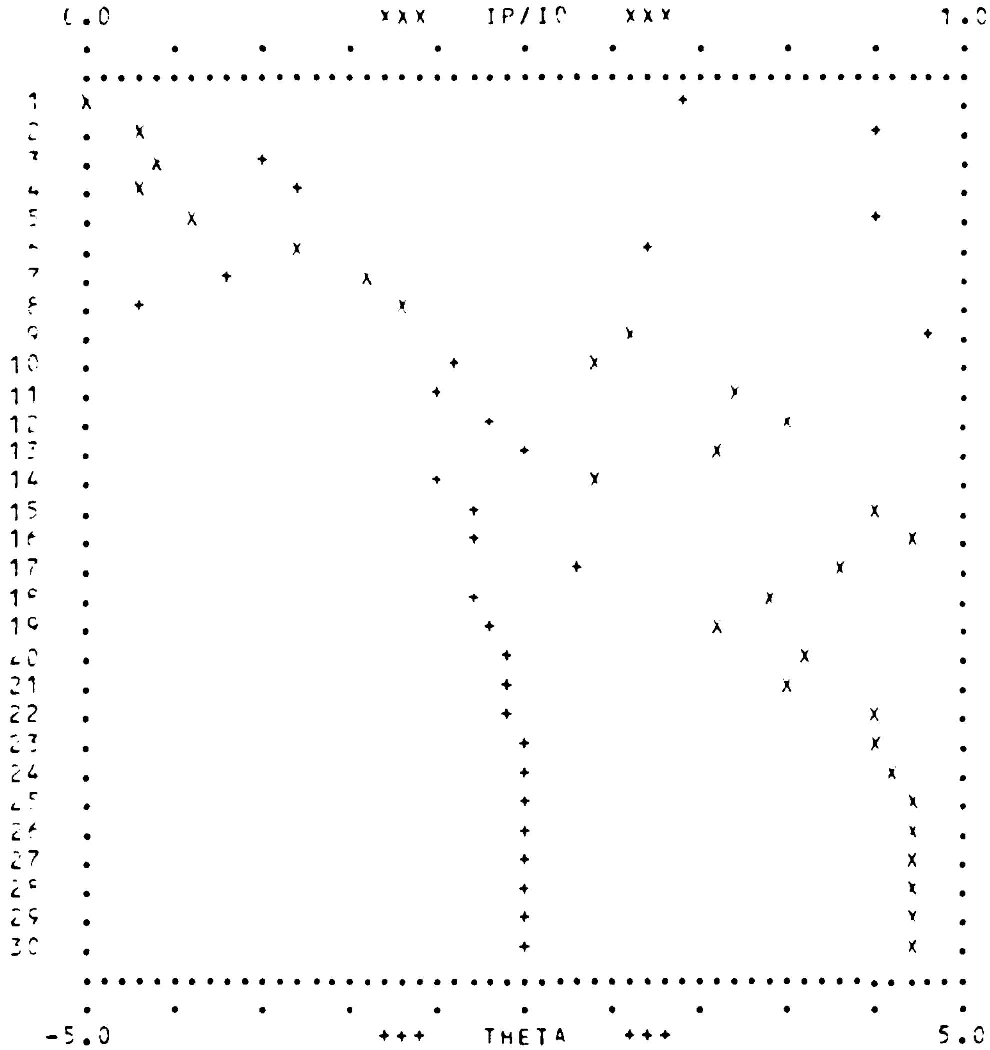

RUN 397. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



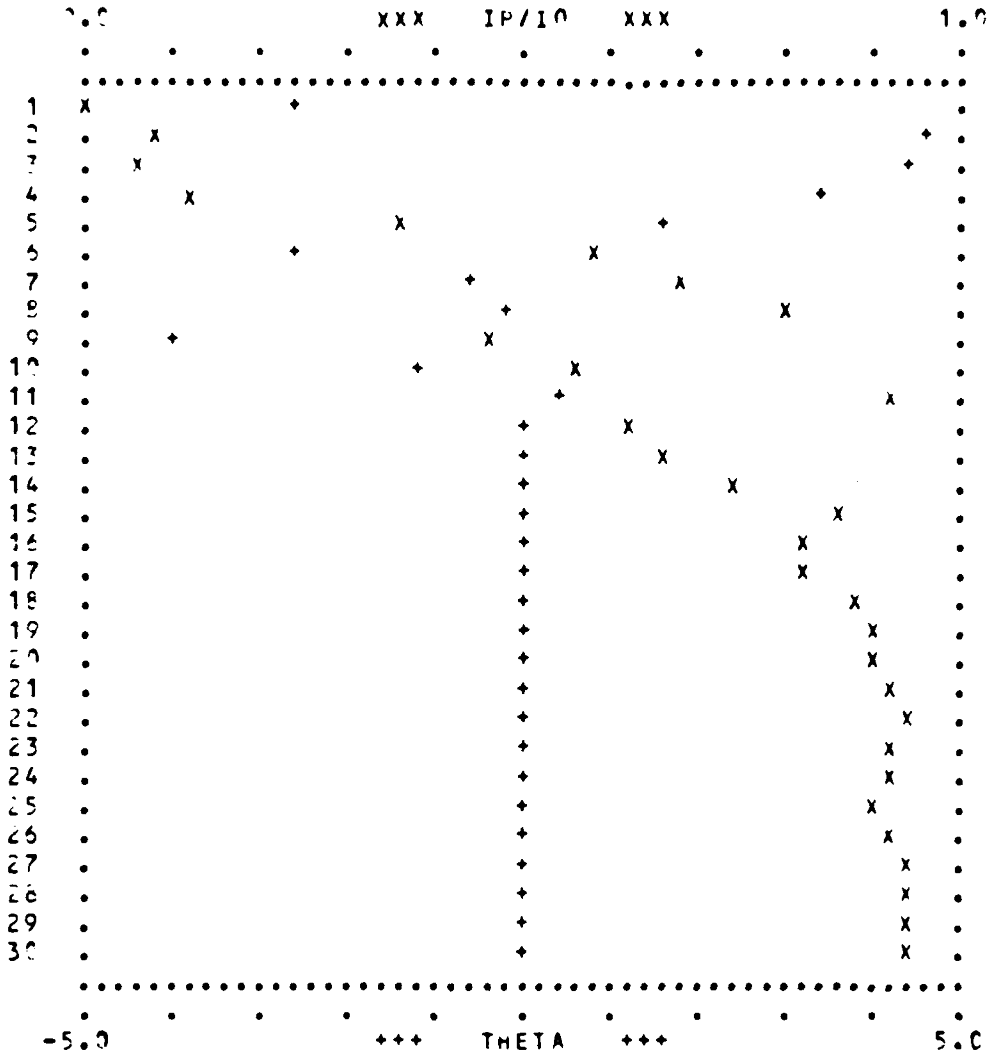
RUN 393. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



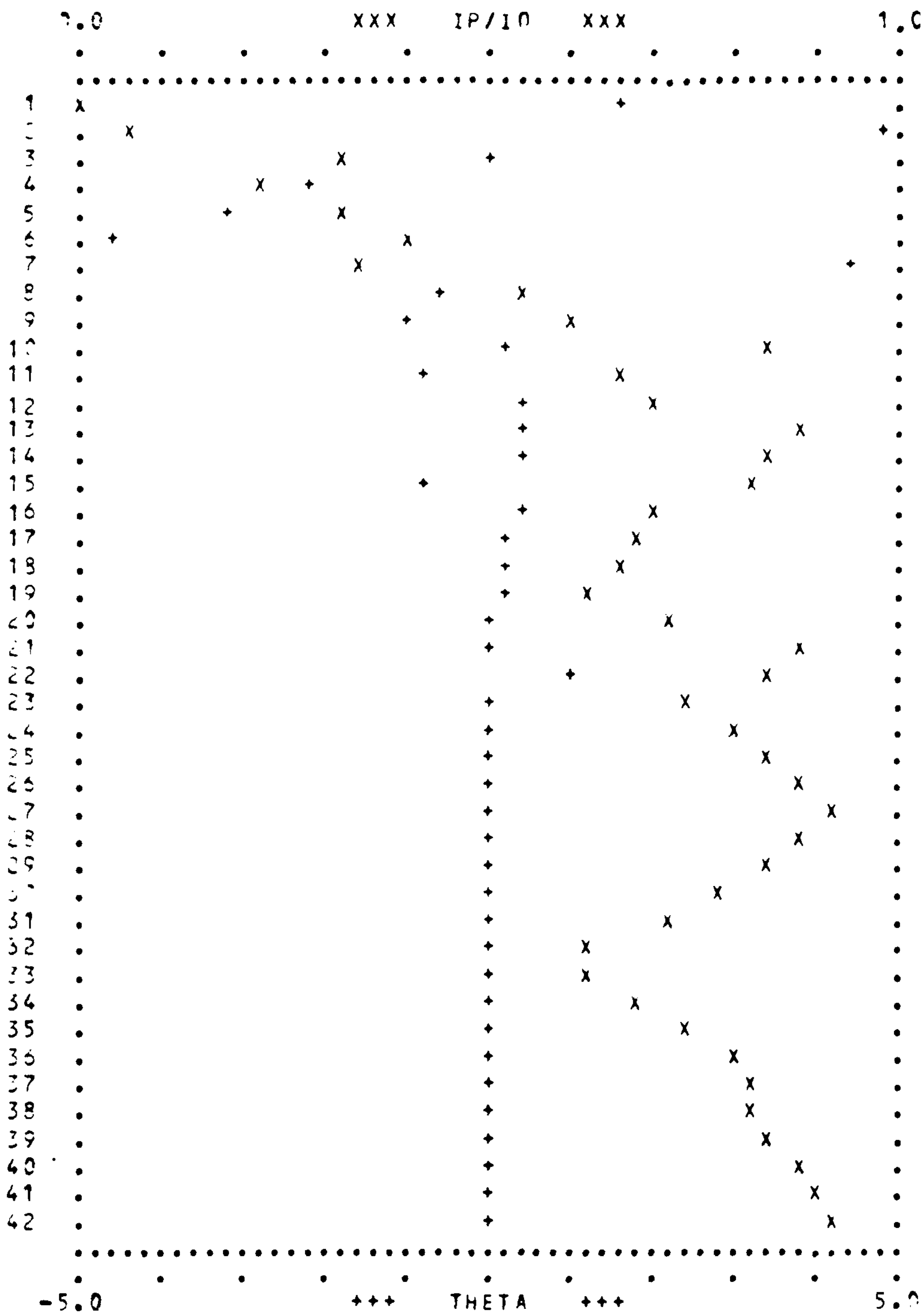
RUN 399. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.41417
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



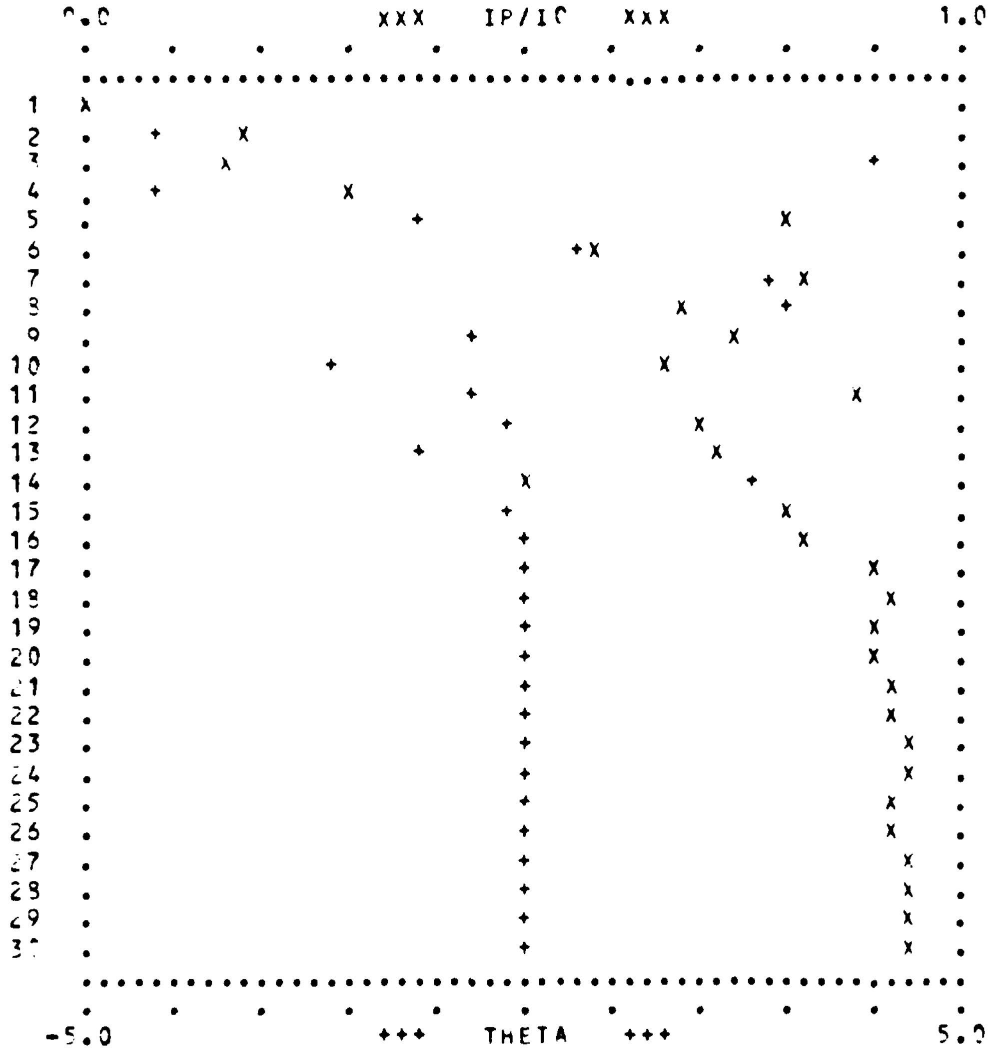

RUN 400. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.41417 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



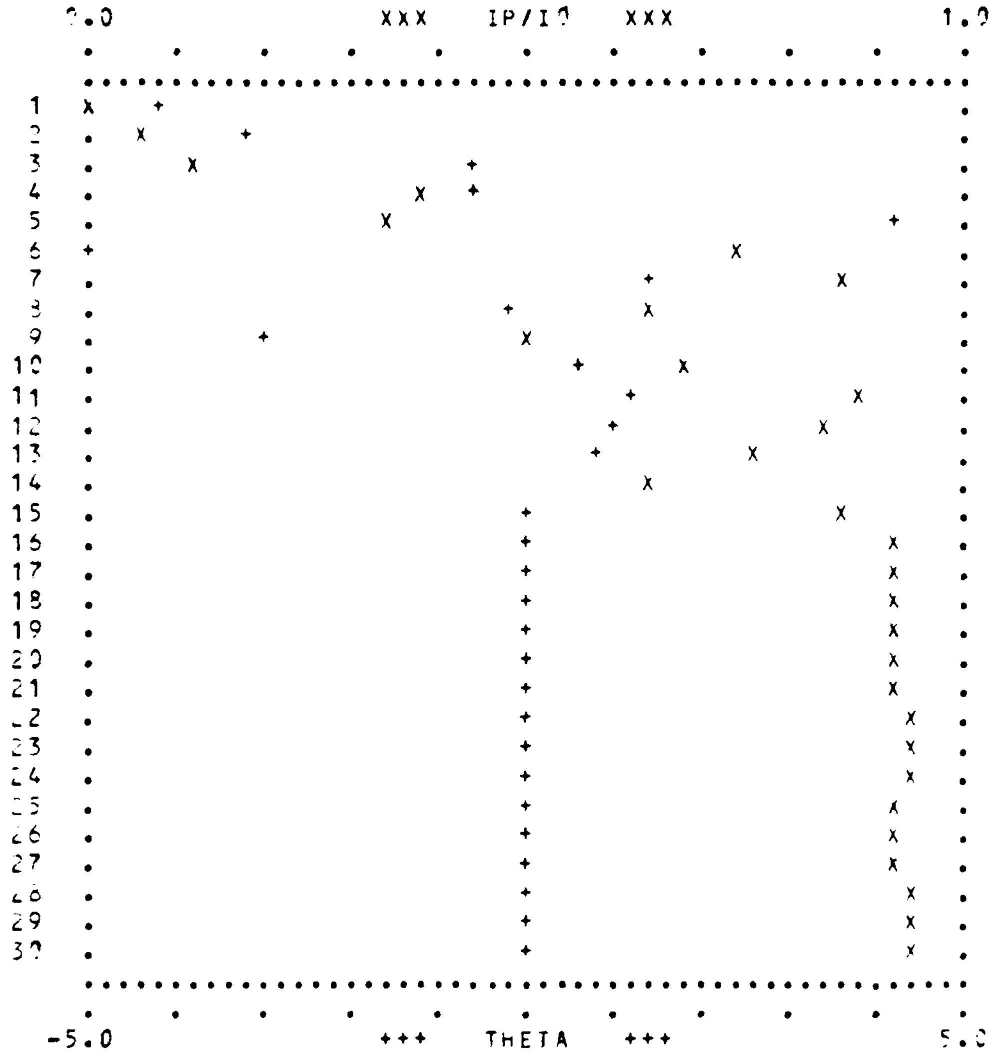

RUN 401. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



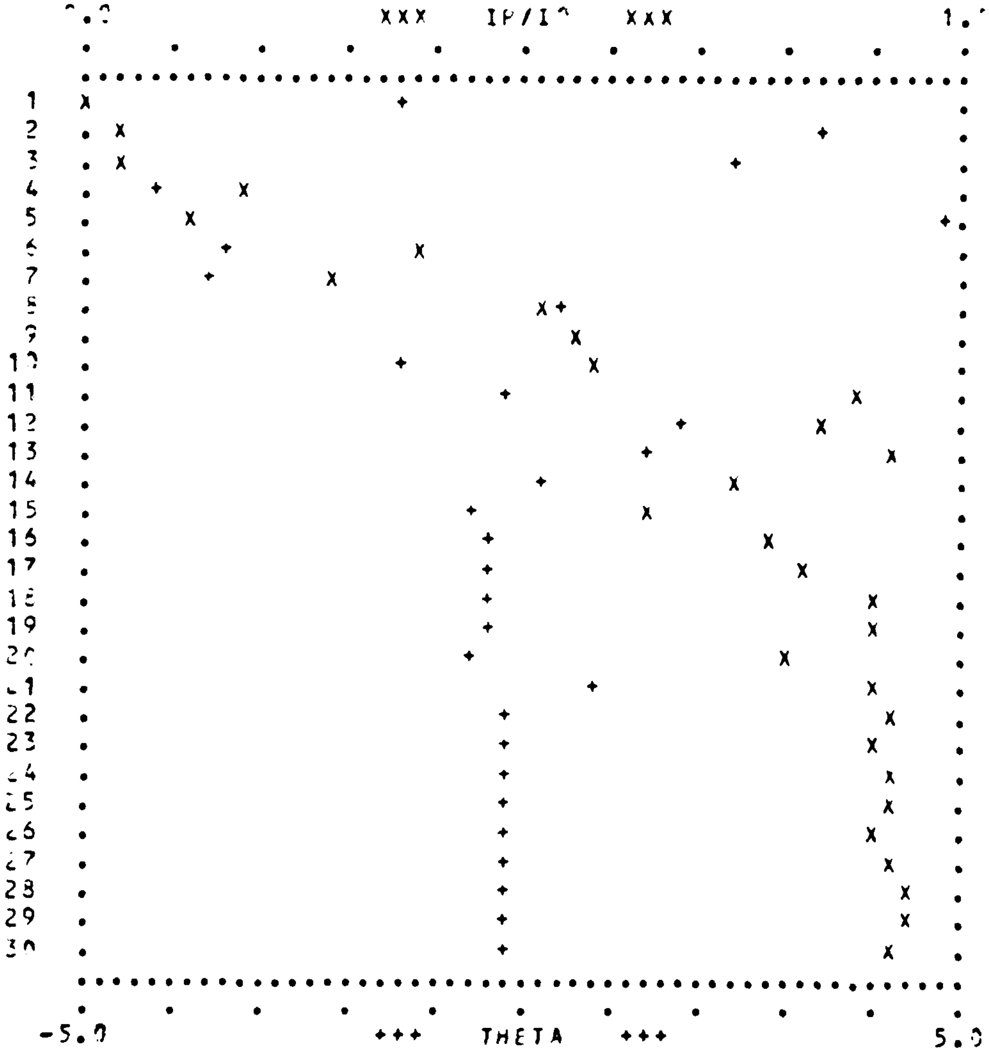
RUN 402. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



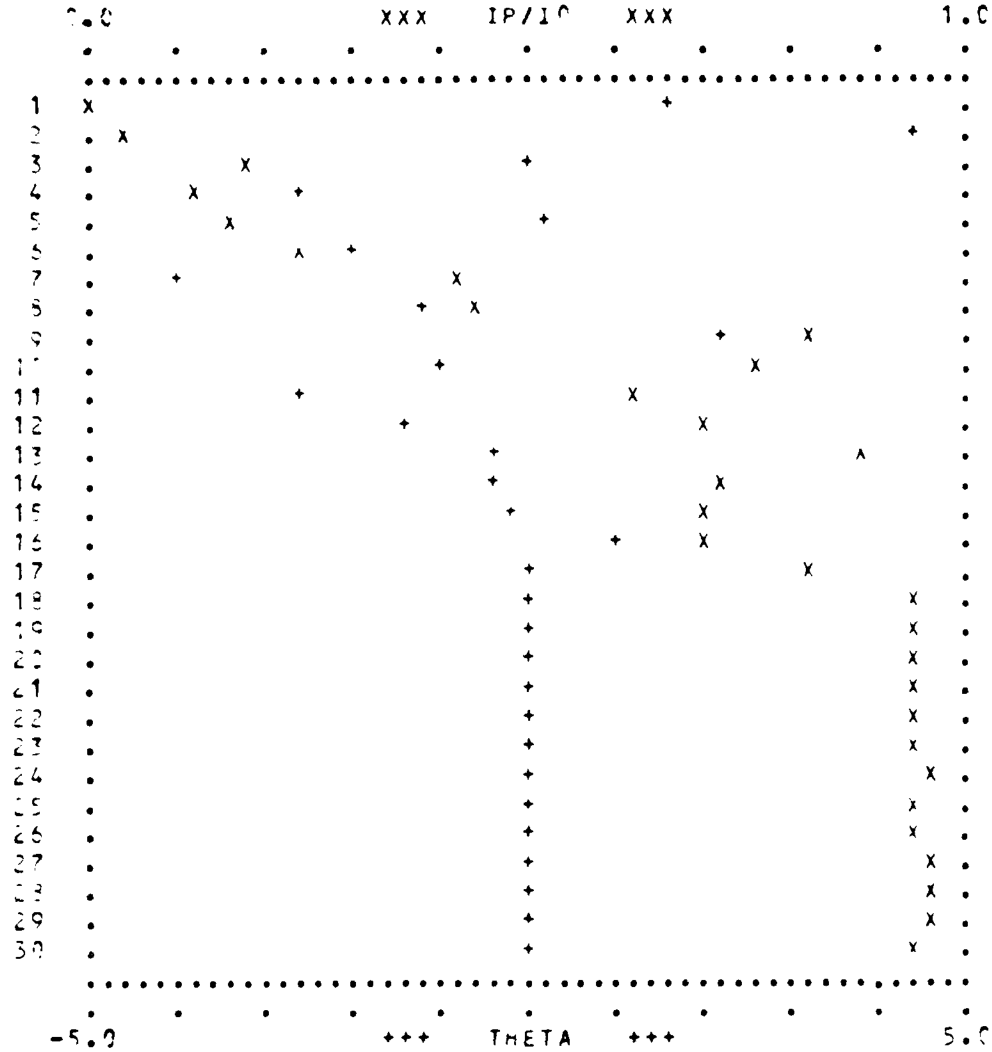

RUN 403. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



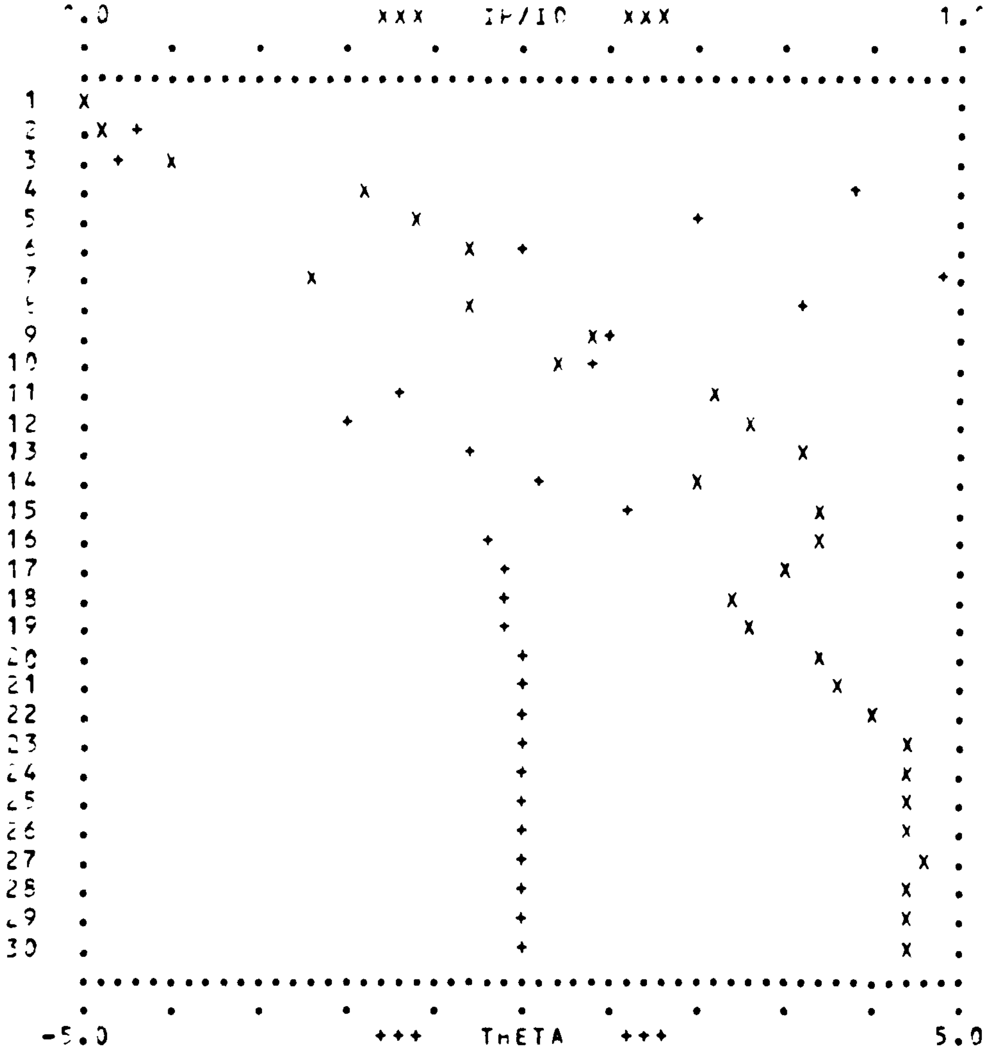

RUN 404. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



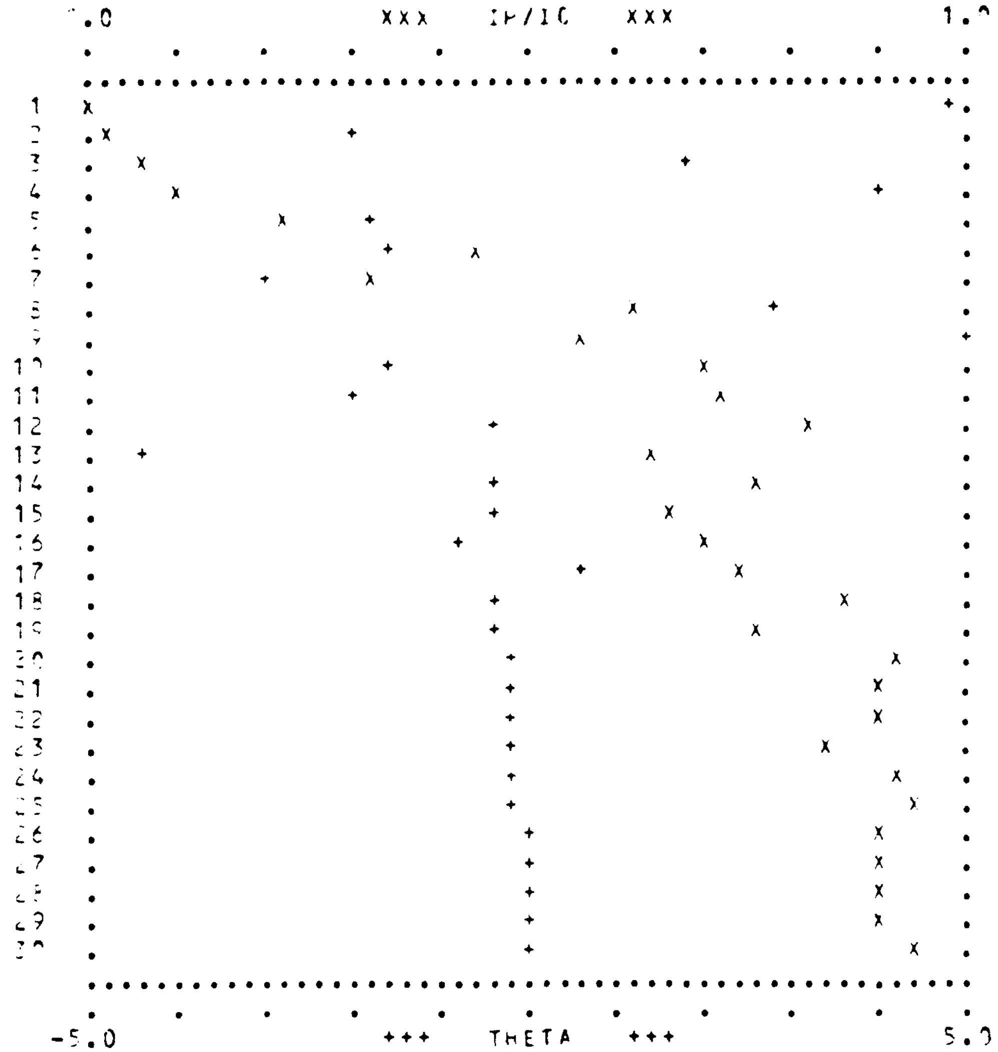

RUN 405. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



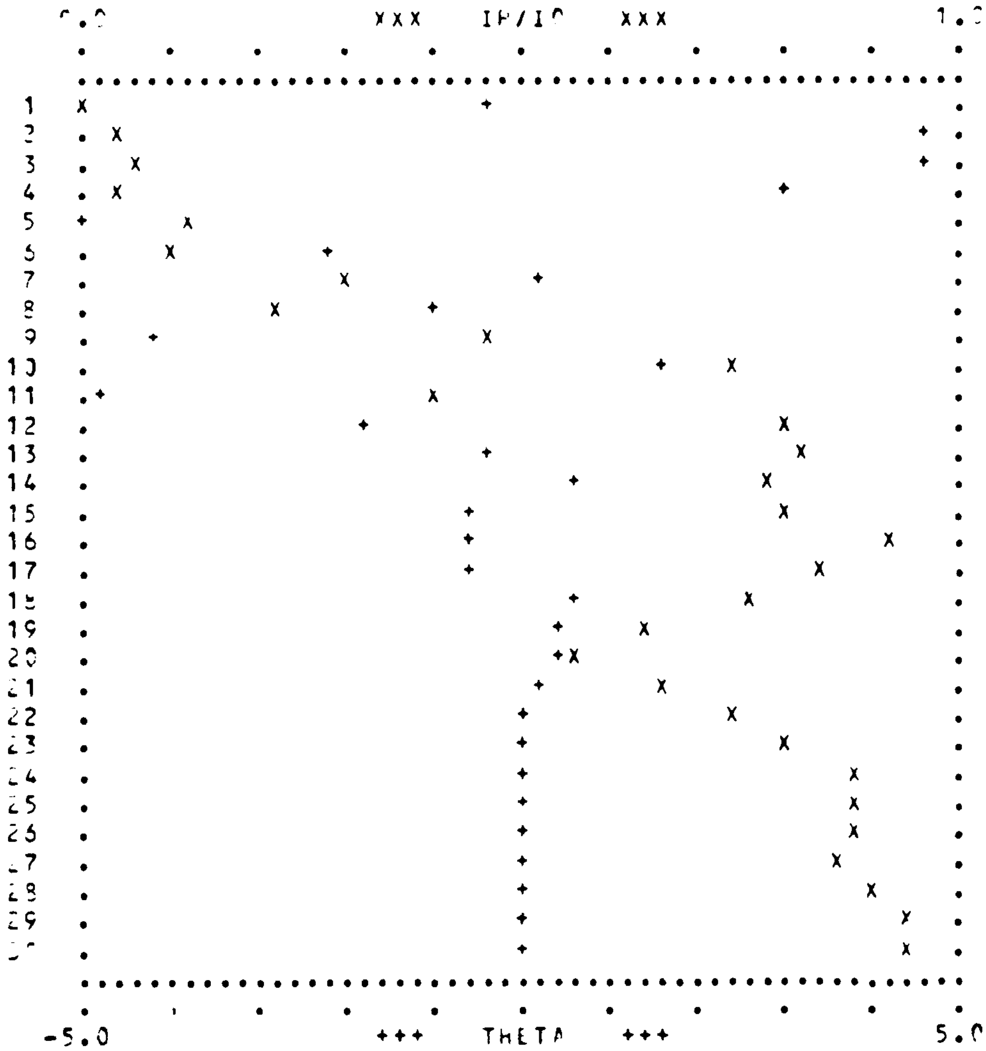

RUN 406. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



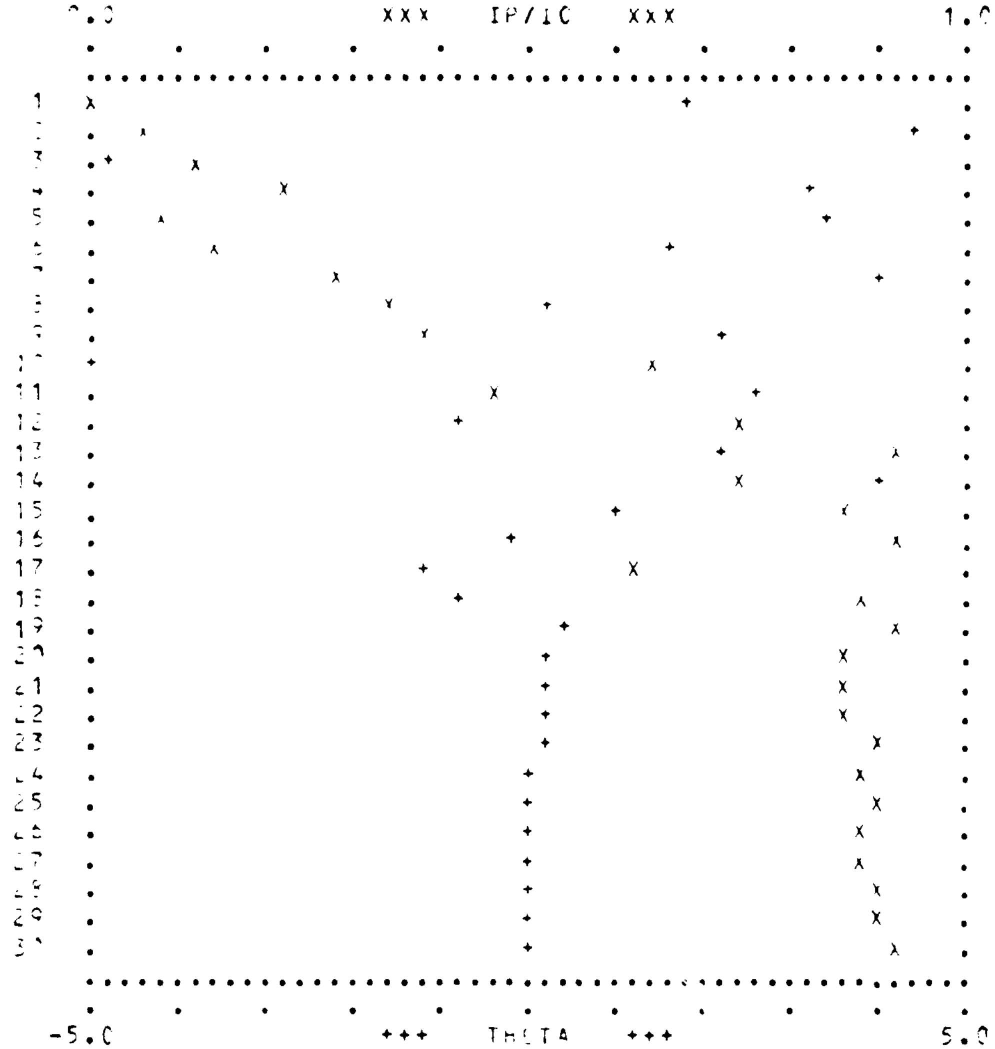

RUN 417. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



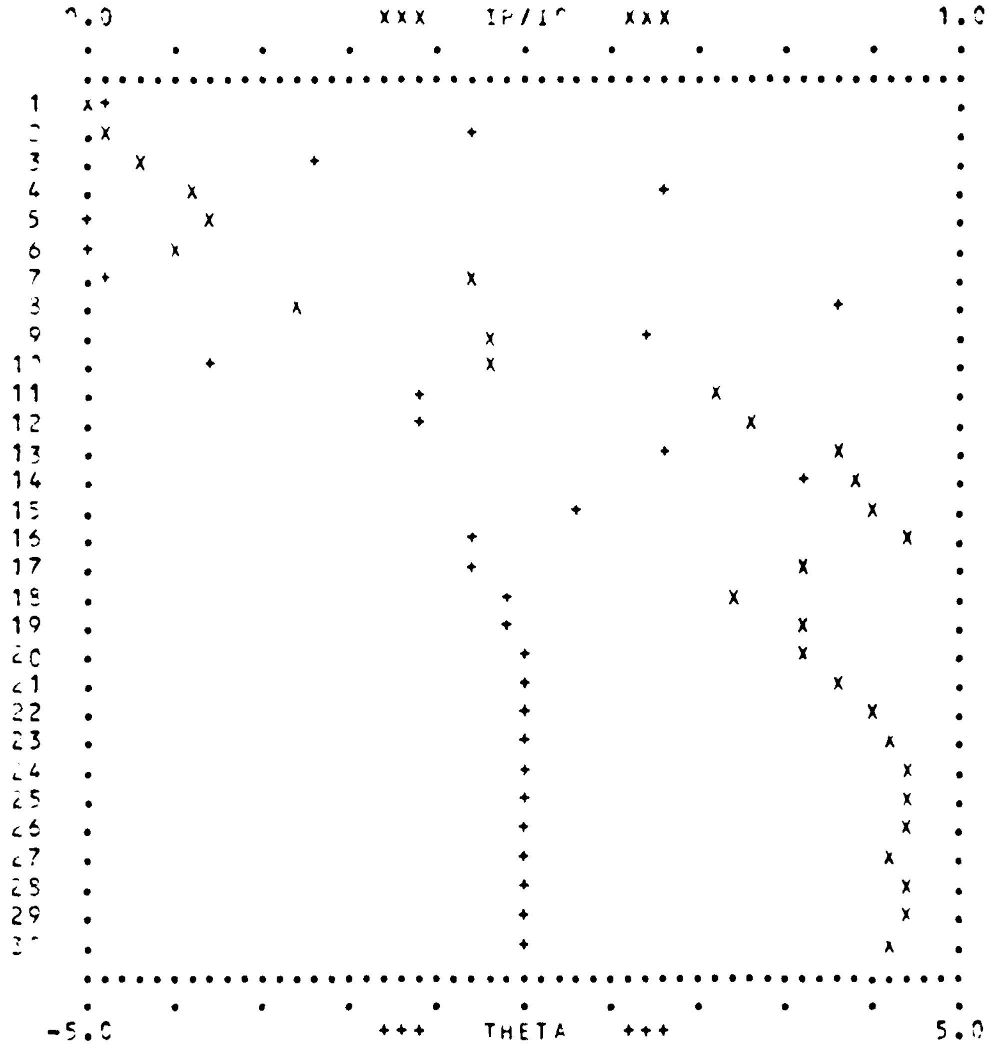
RUN 408. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IF/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



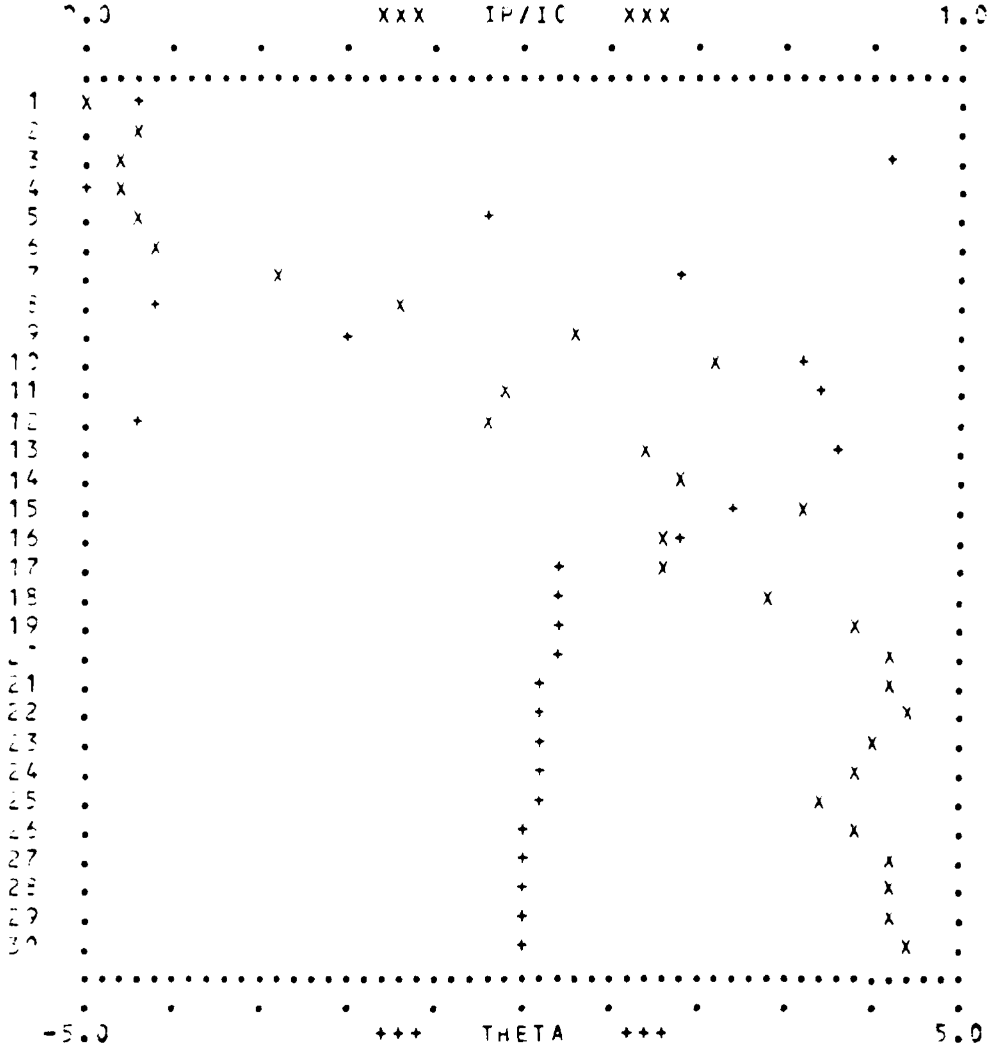
RUN 409. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 3?7.20000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



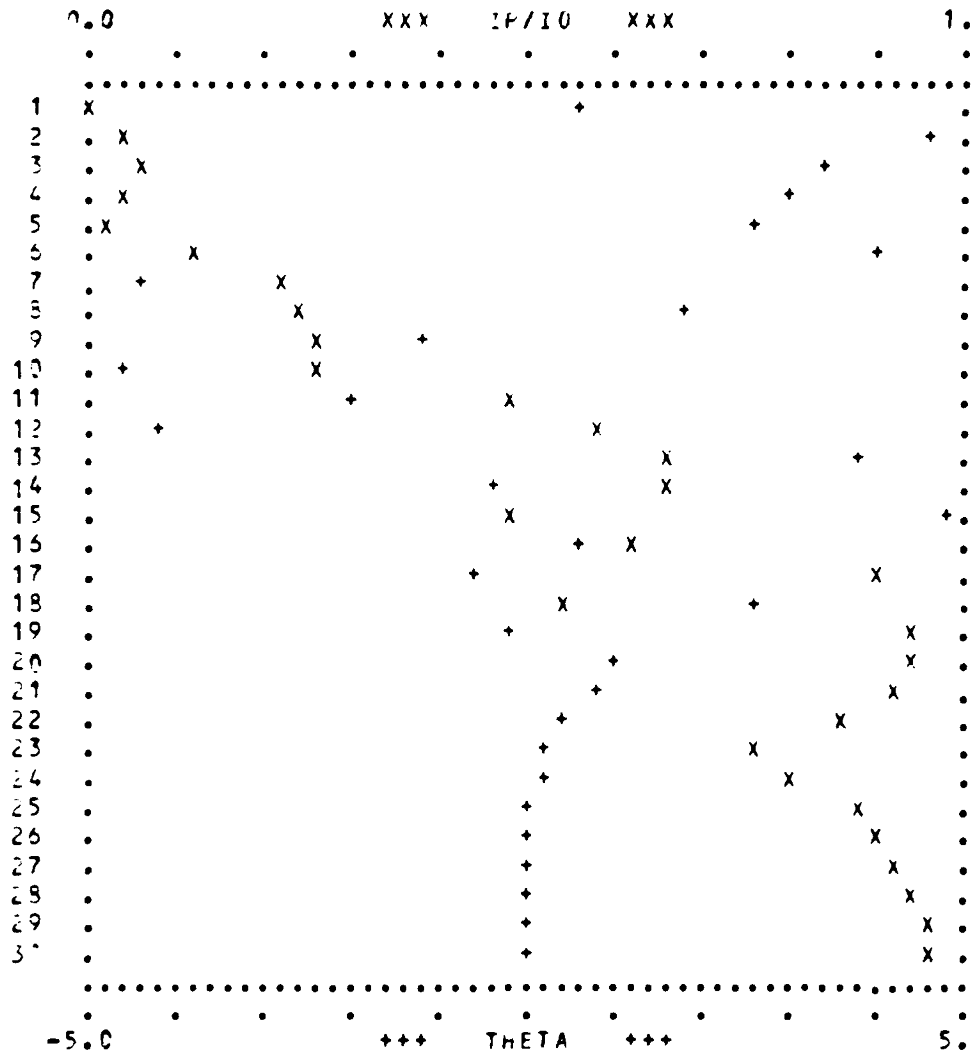

RUN 419. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



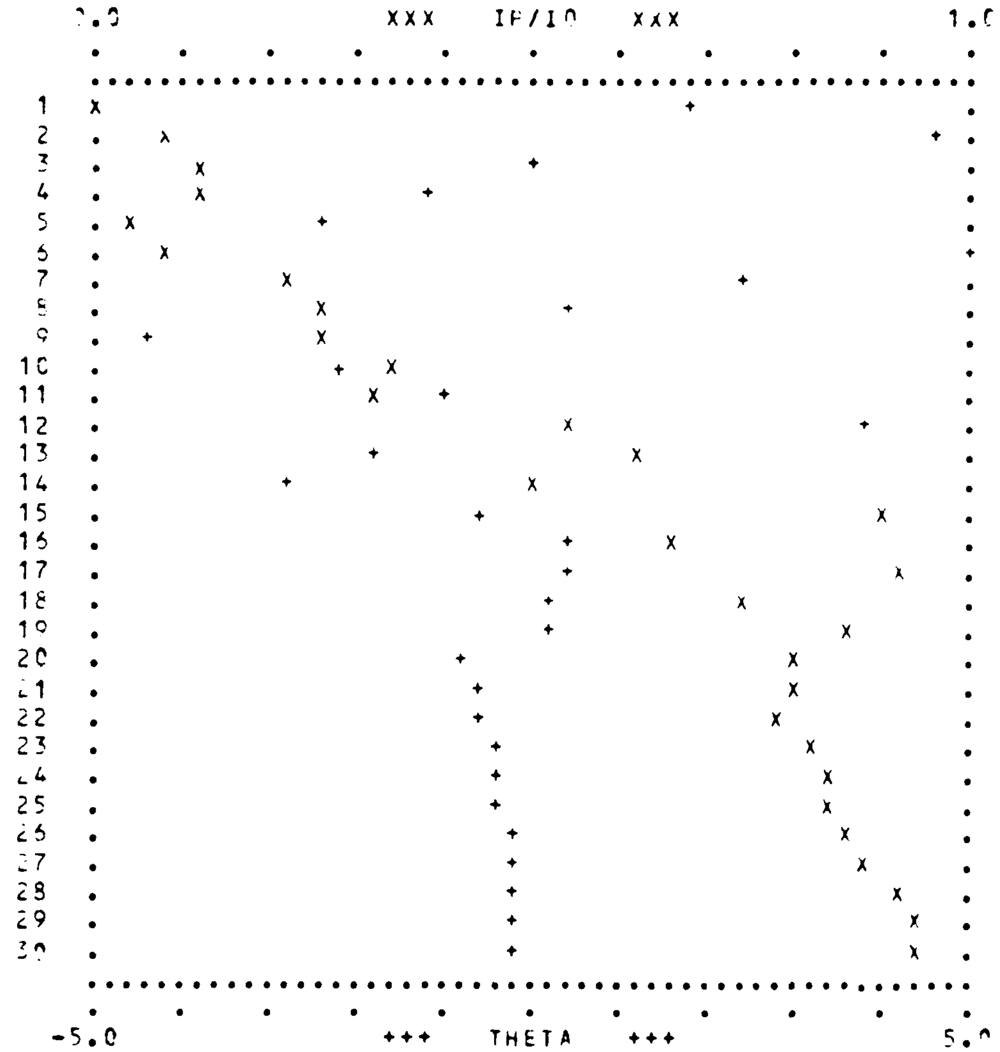

RUN 411. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



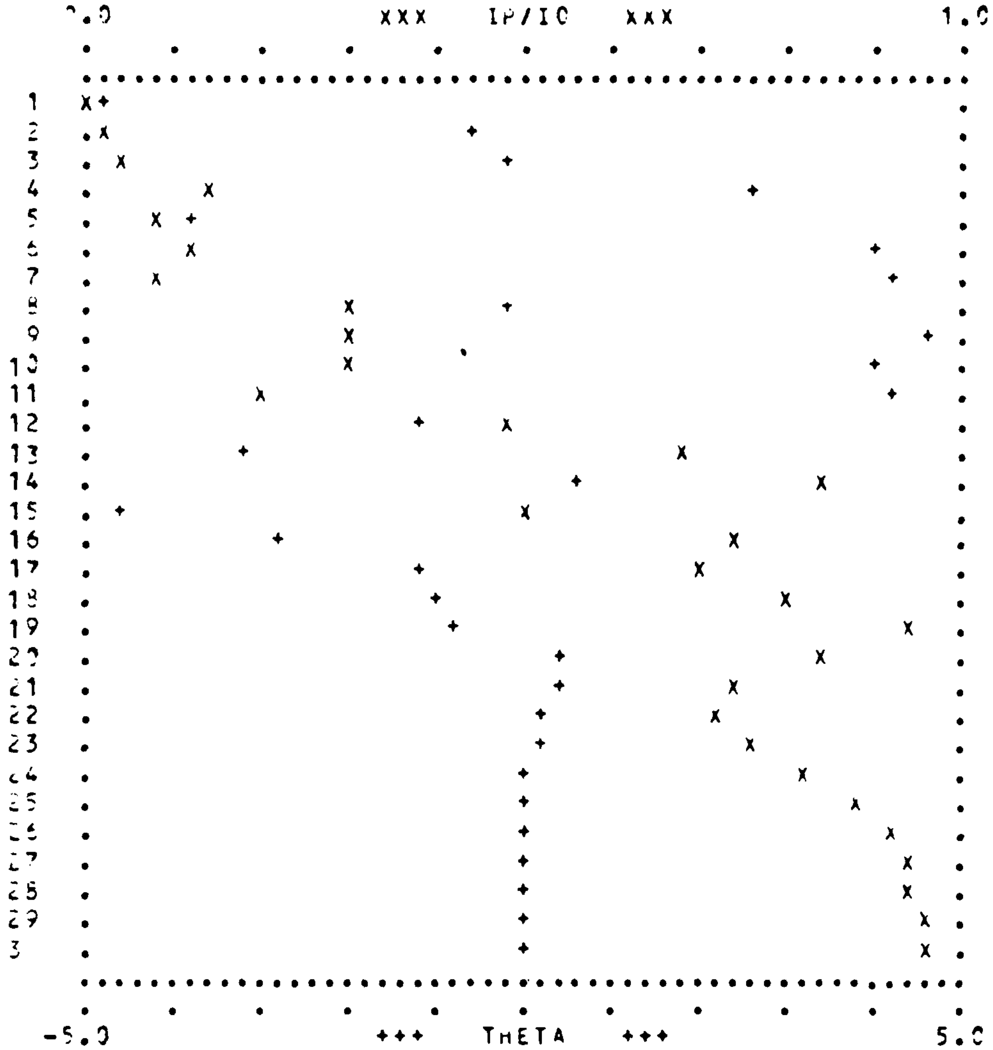

RUN 412. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



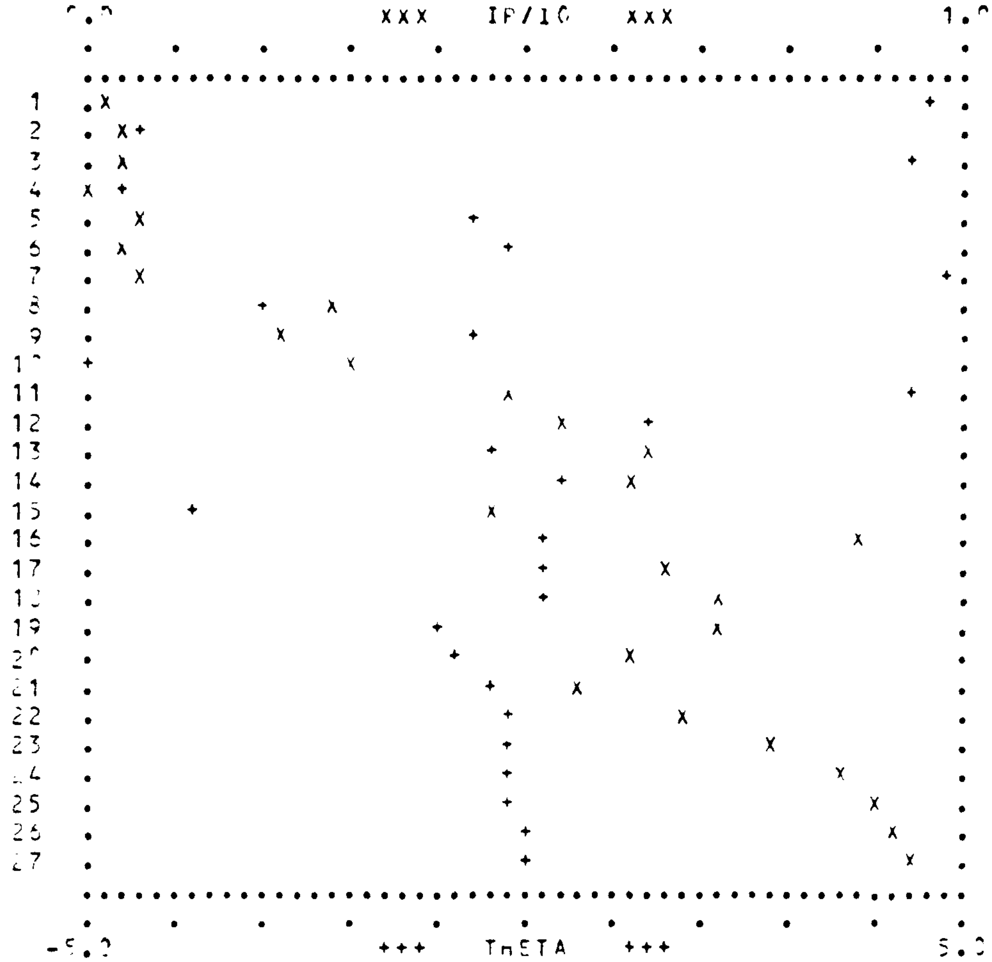

RUN 413. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



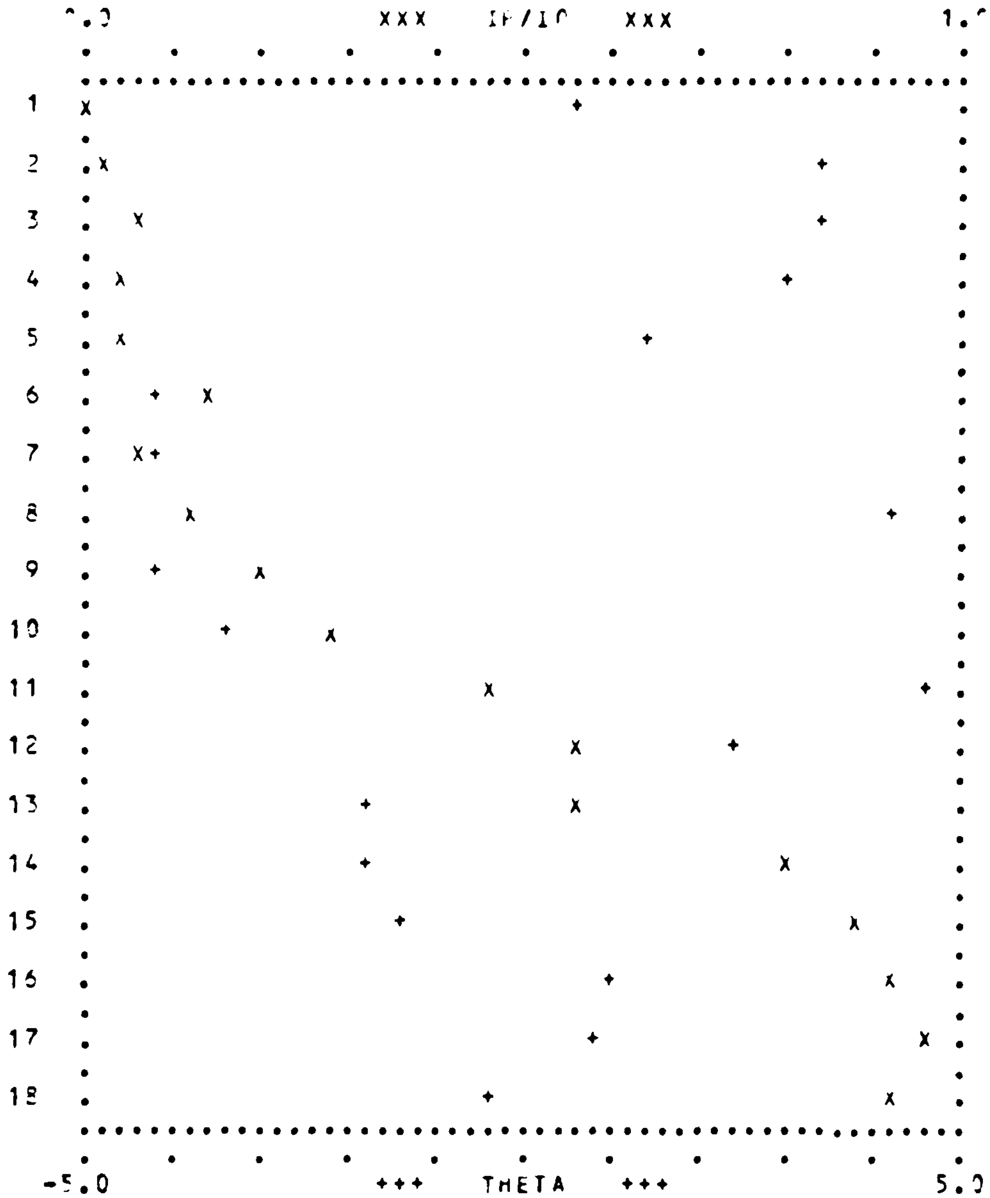

RUN 414. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



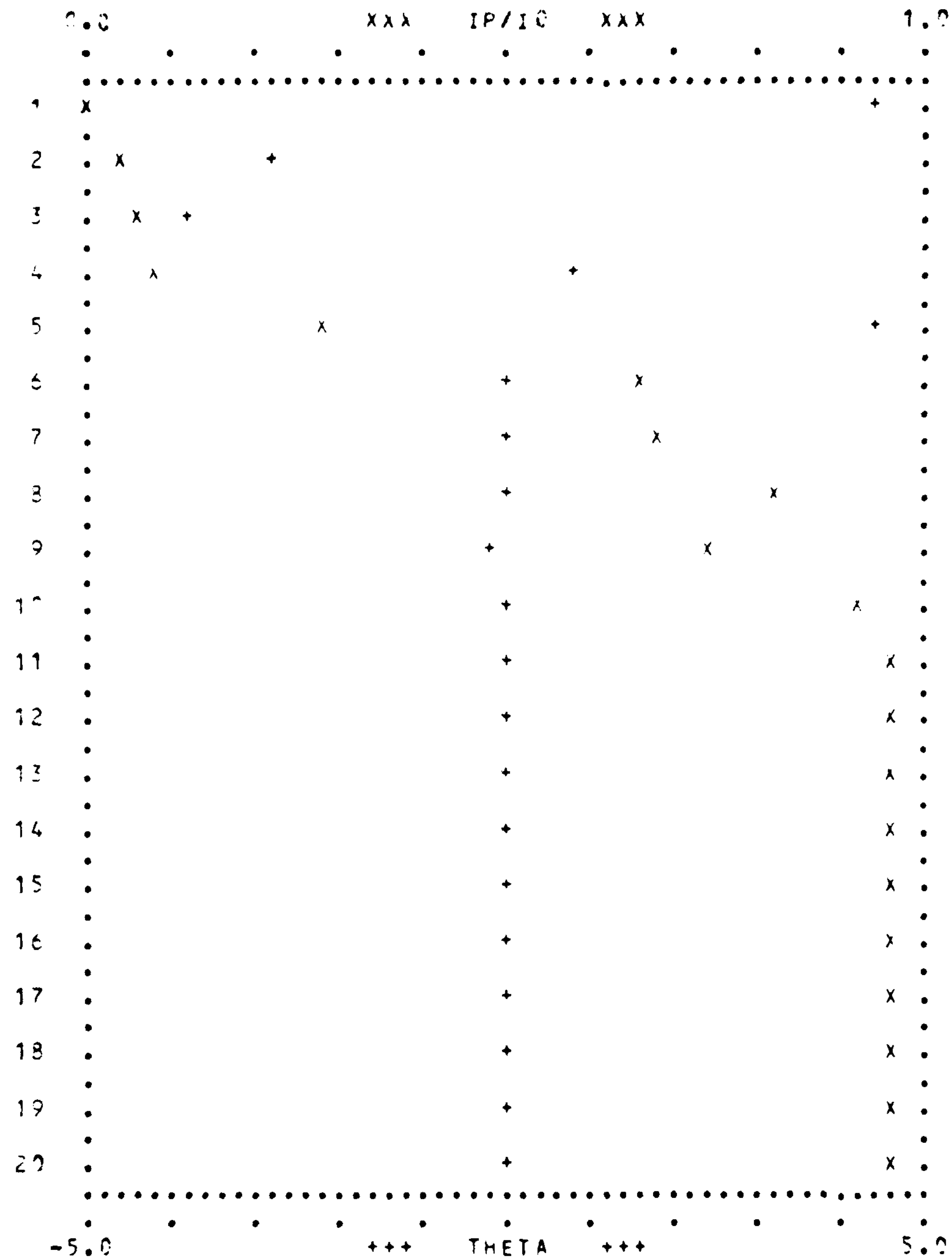

RUN 415. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.31996
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



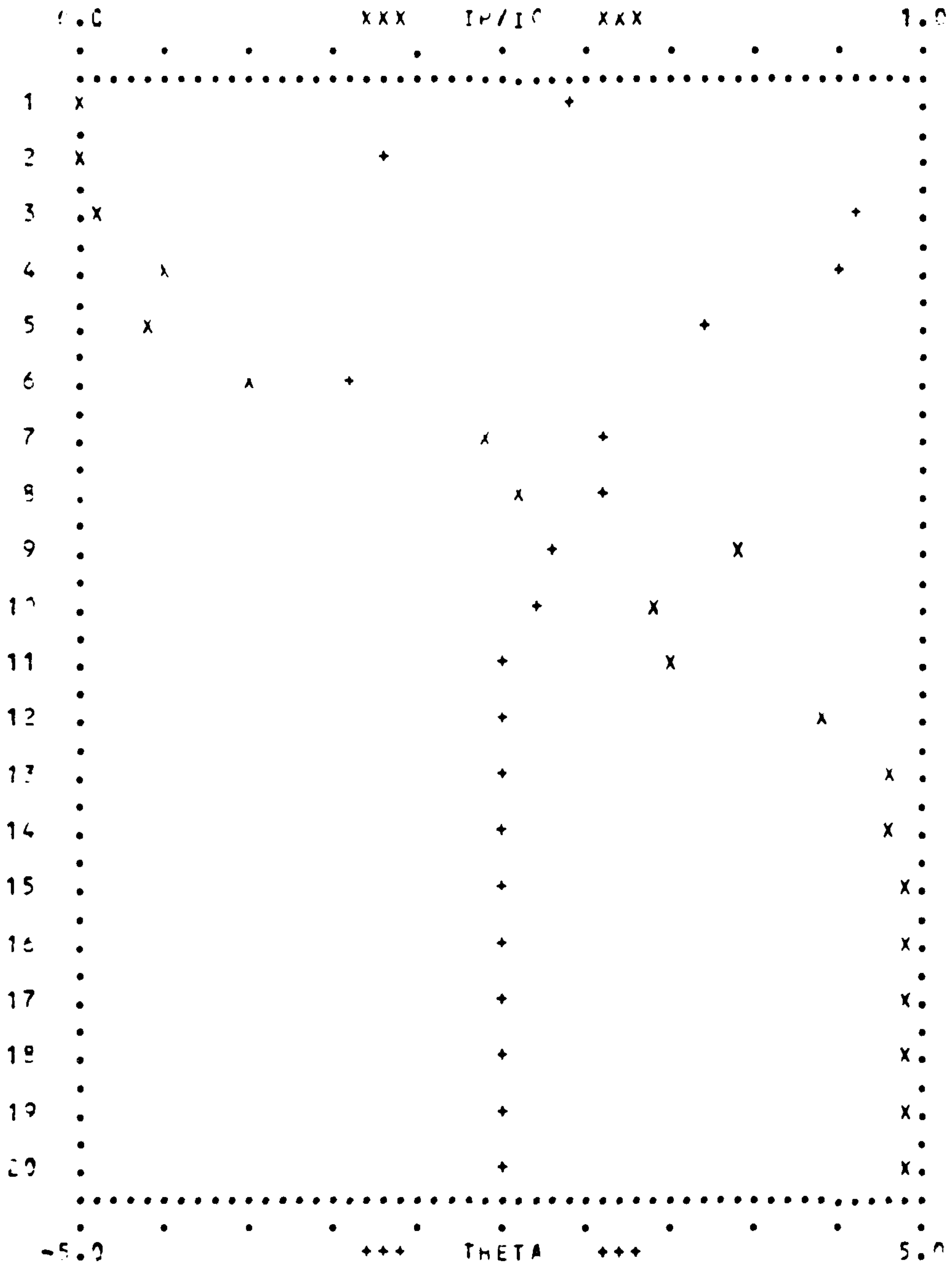

RUN 416. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



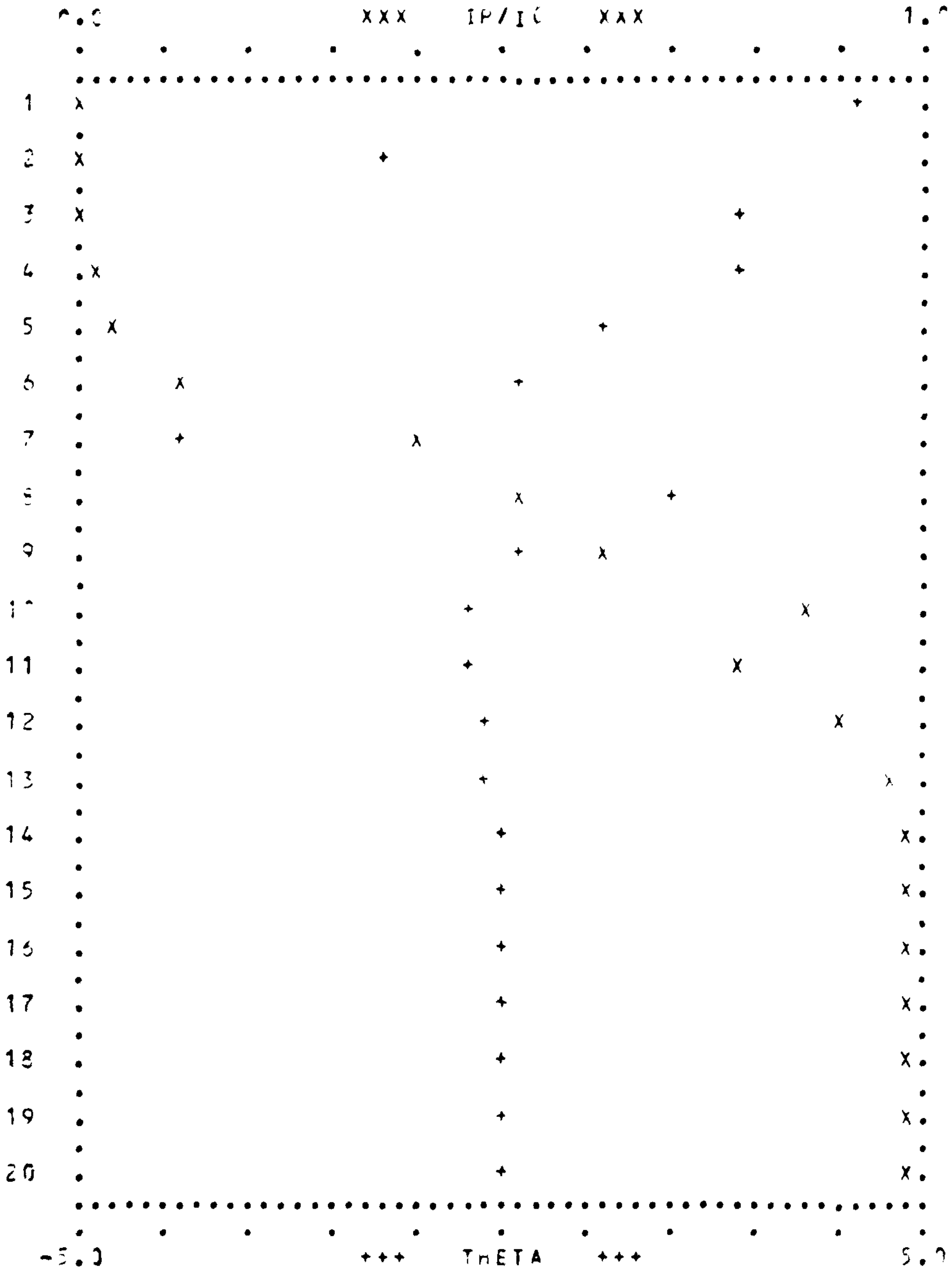

RUN 417. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=1.31996 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



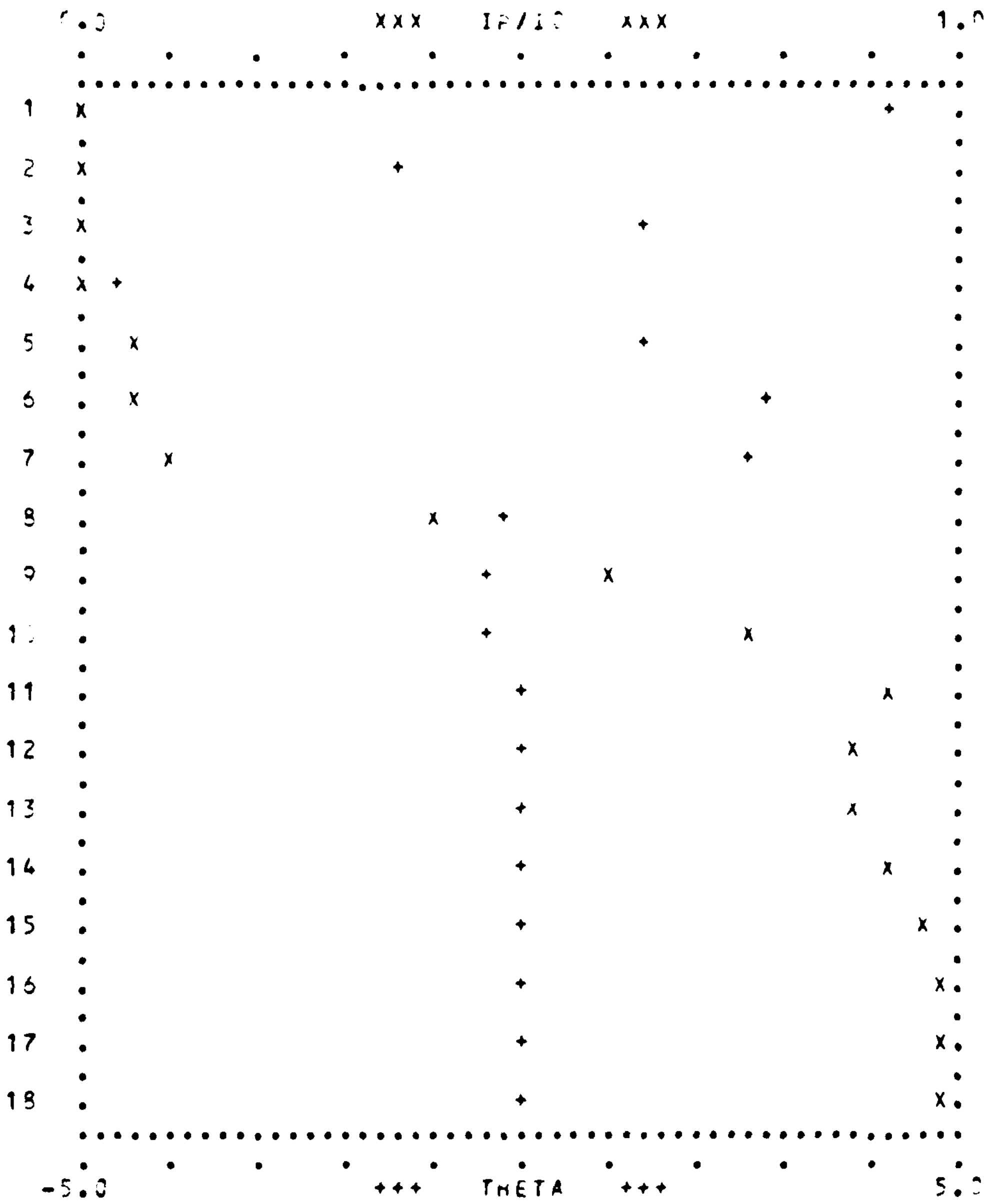

RUN 521. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00000 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



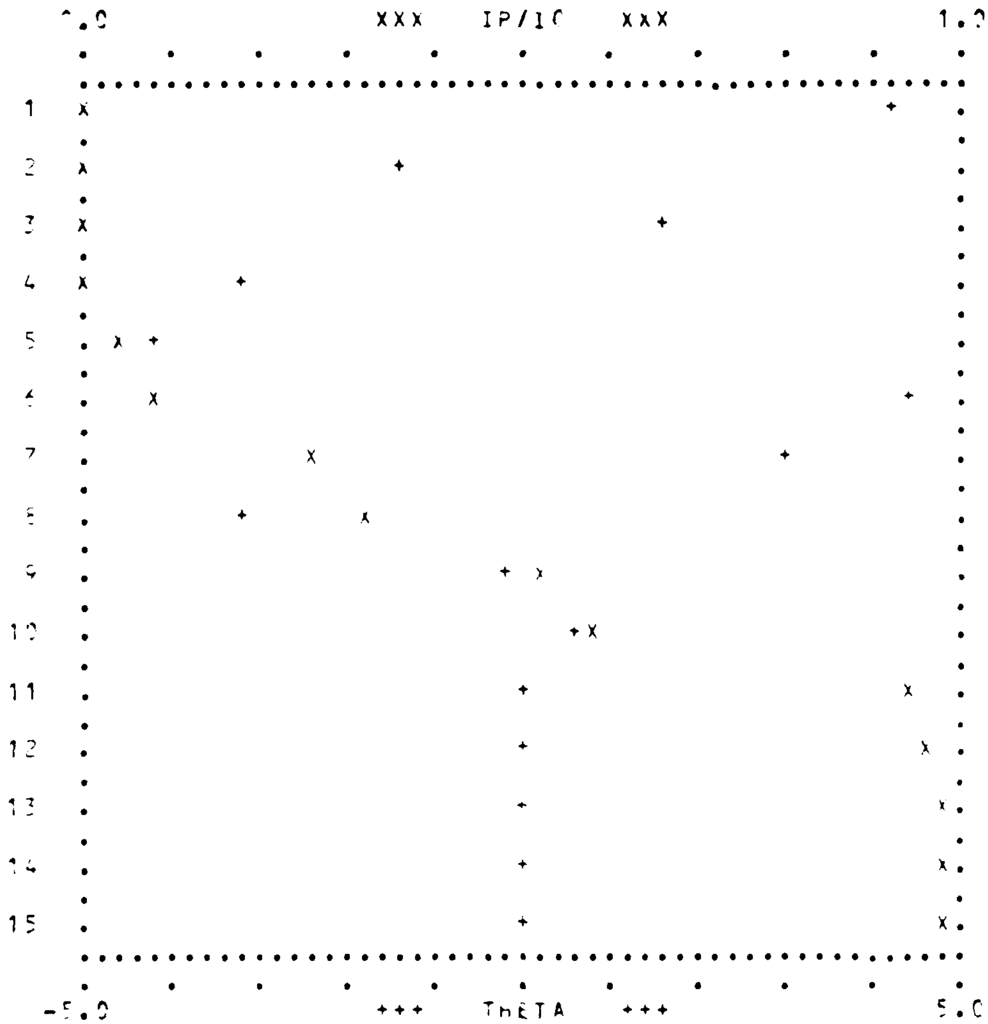

RUN 522. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



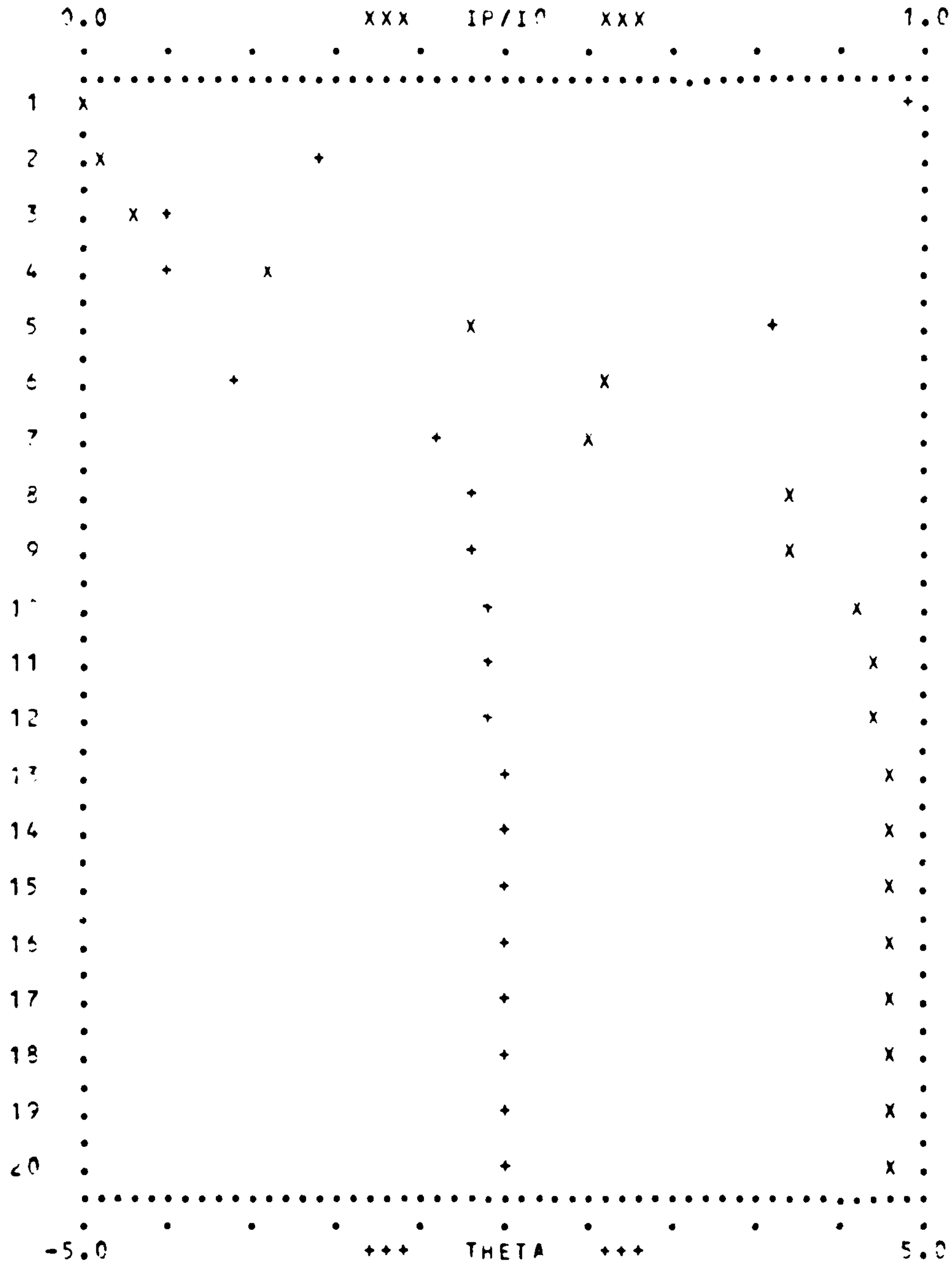

RUN 523. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1225.80000;MAGNIFICATION=2.00000 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



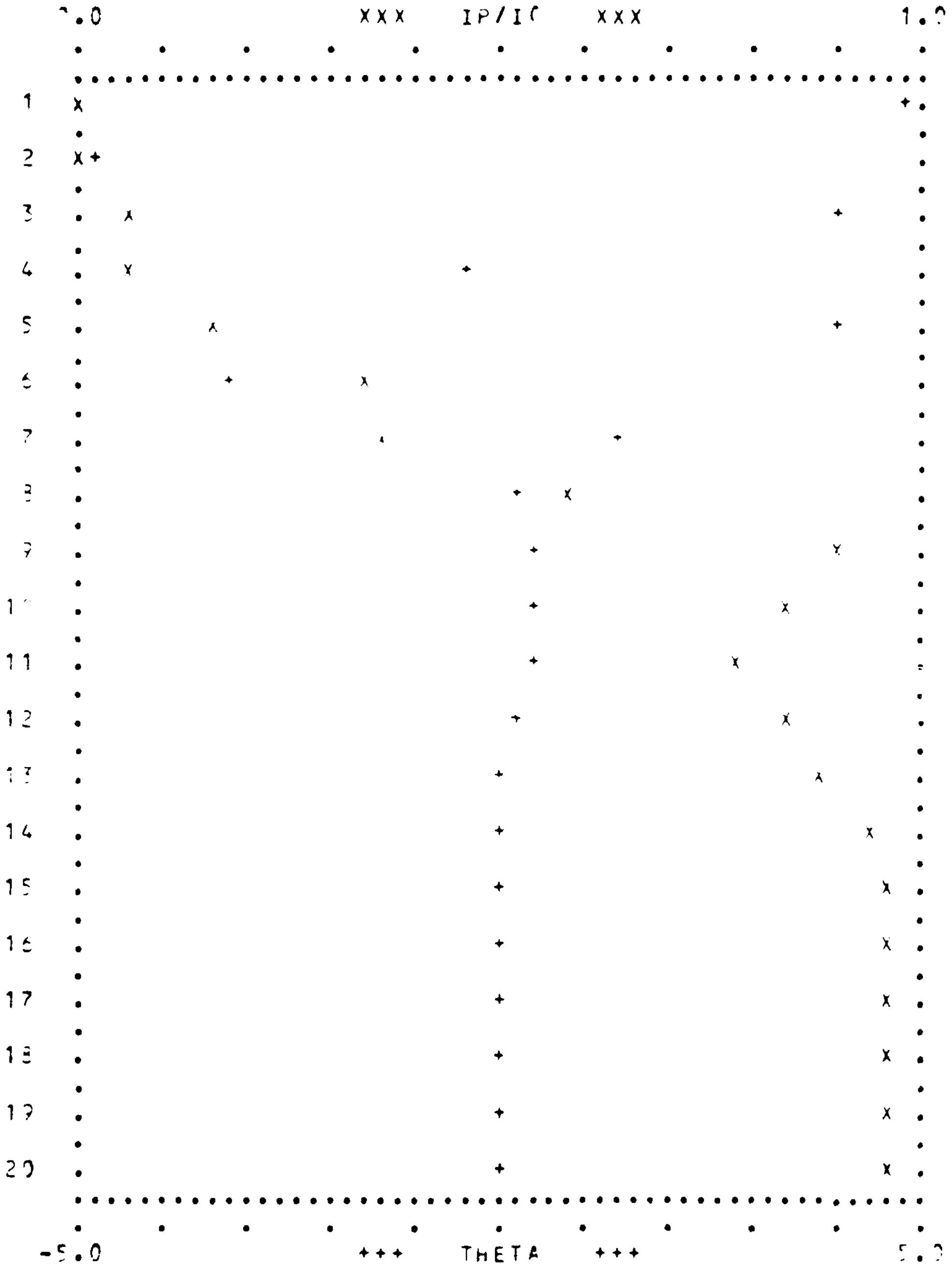

RUN 524. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 2457.60001;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



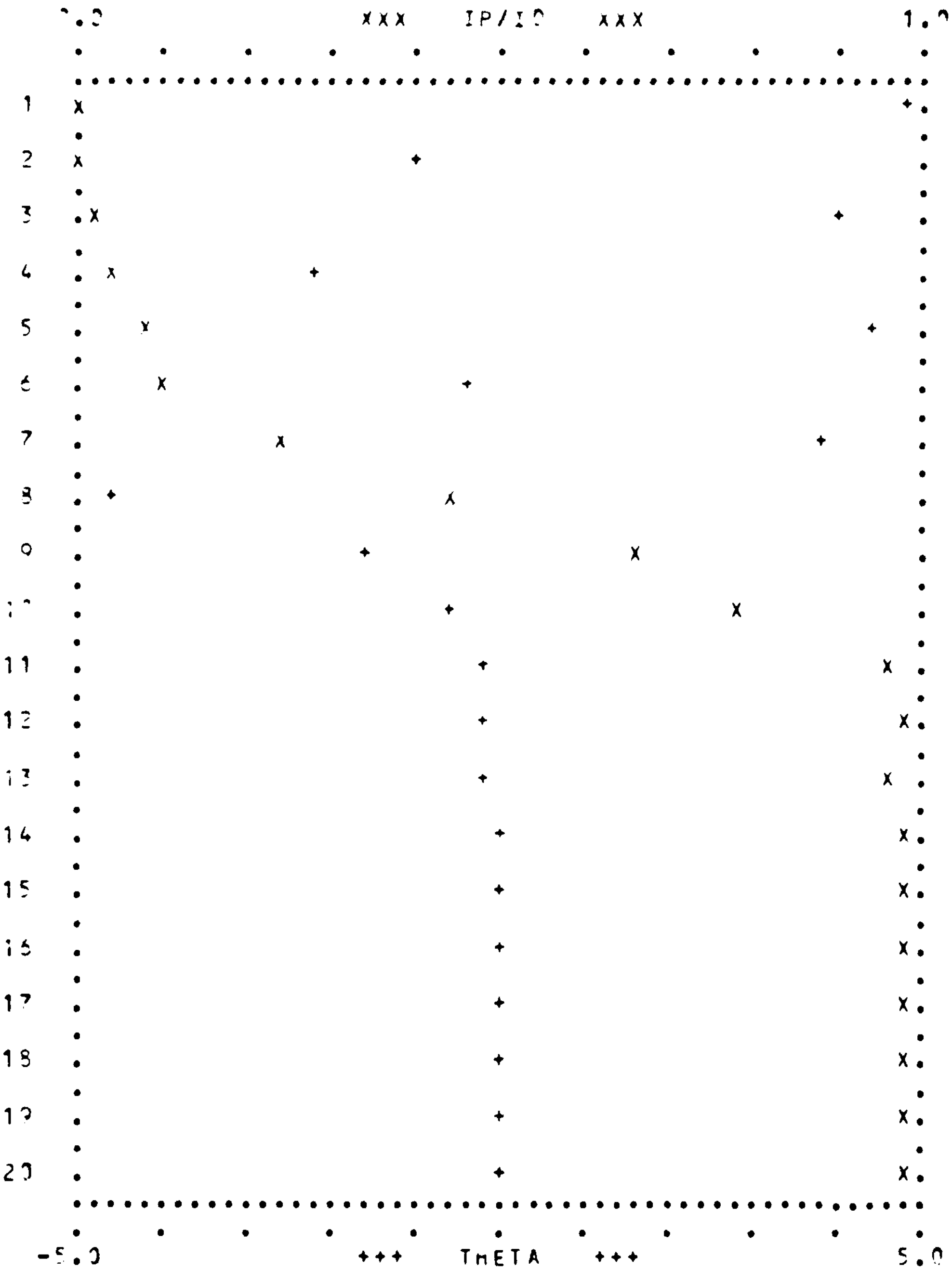

RUN 525. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IF/IC, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 4915.20001;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



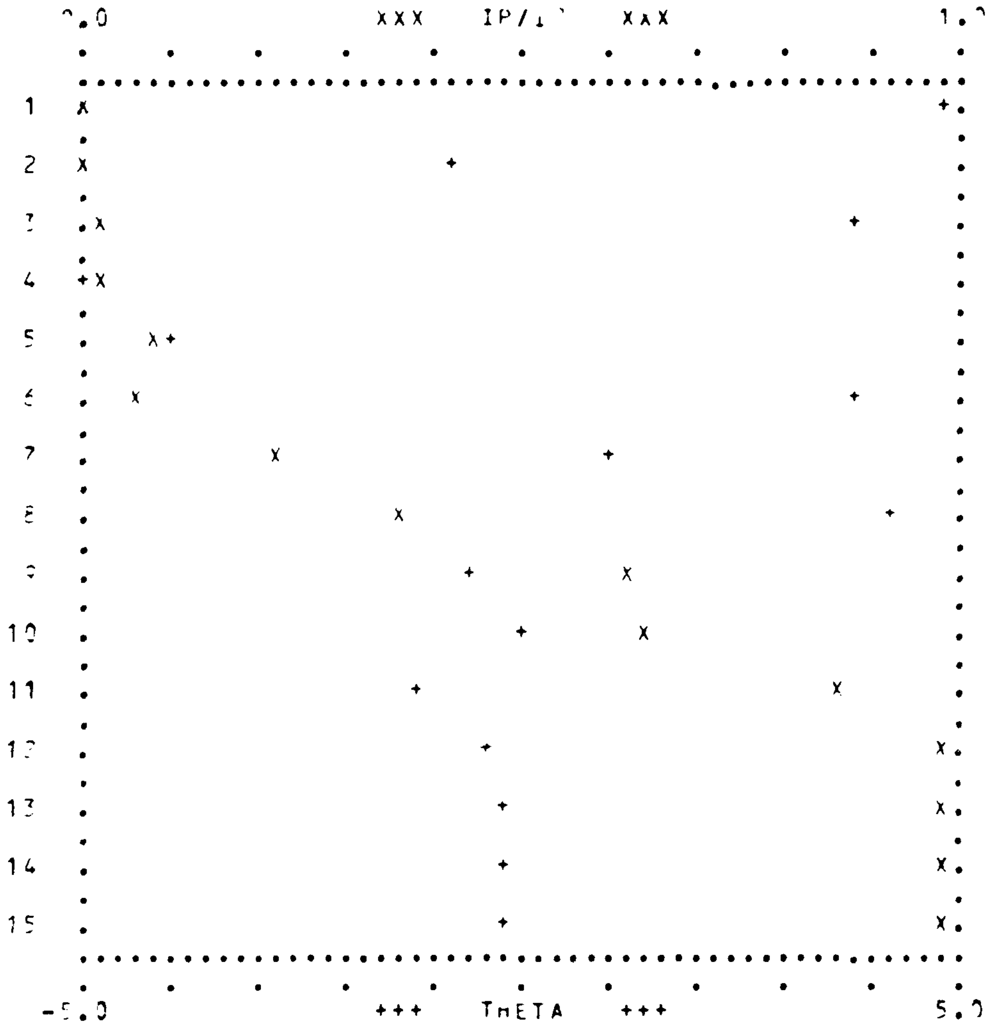

RUN 526. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



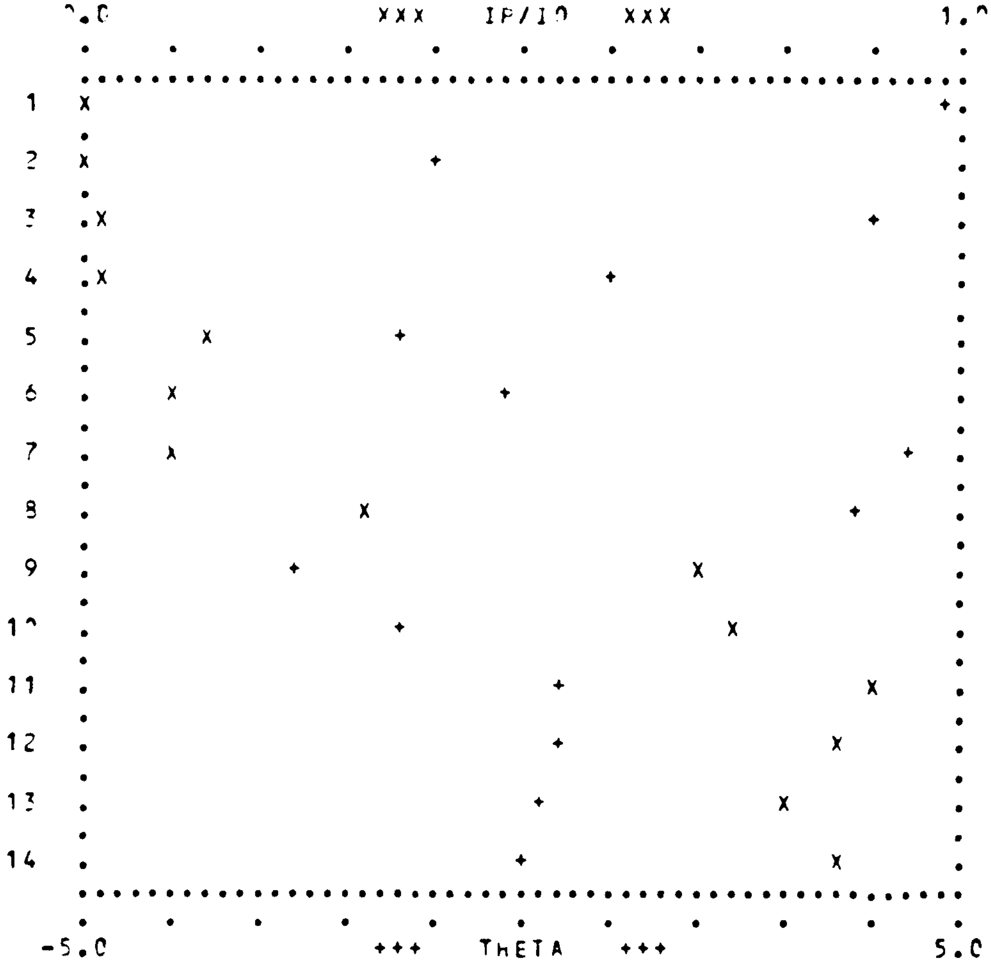

RUN 527. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00000 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=204[illegible].



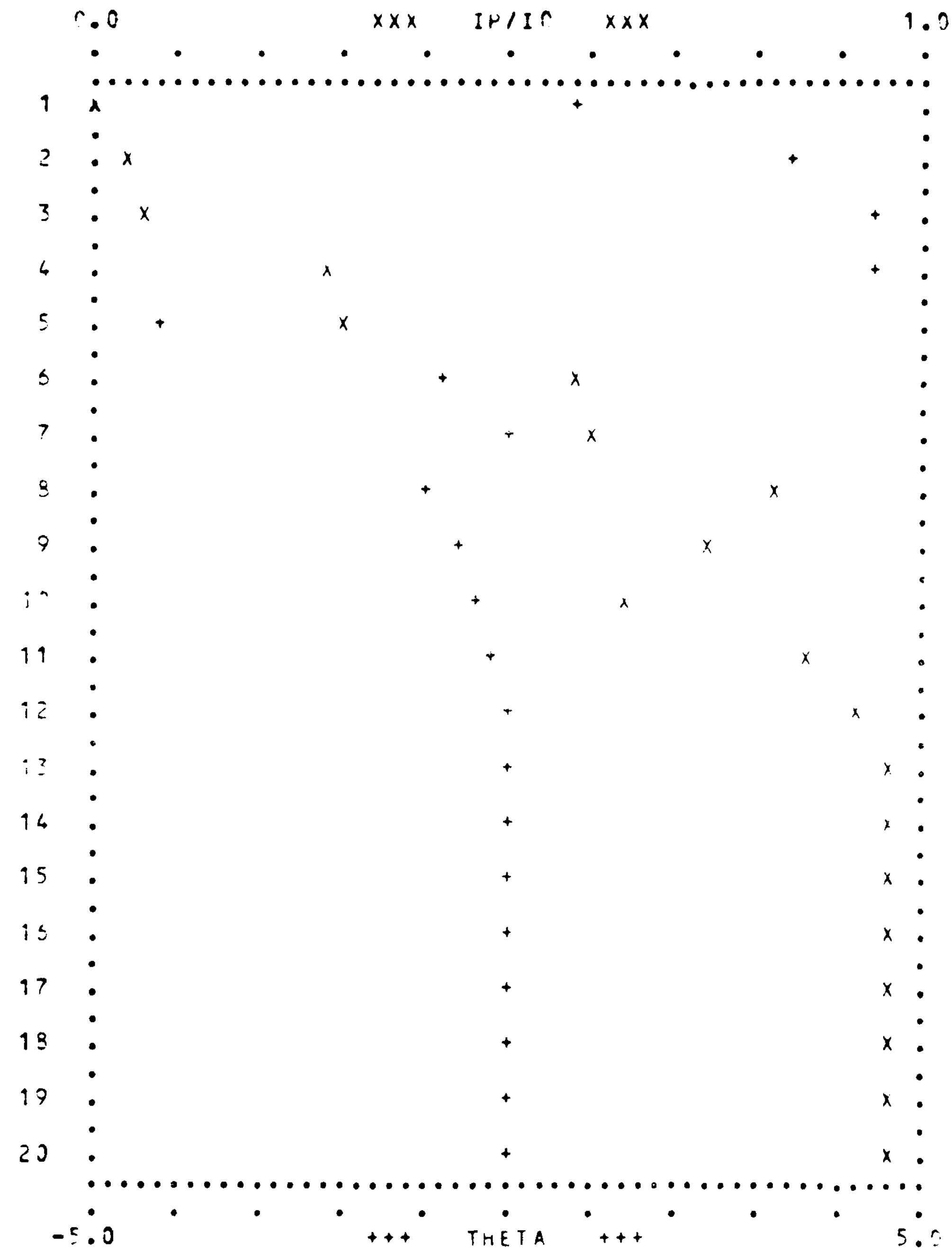

RUN 528. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



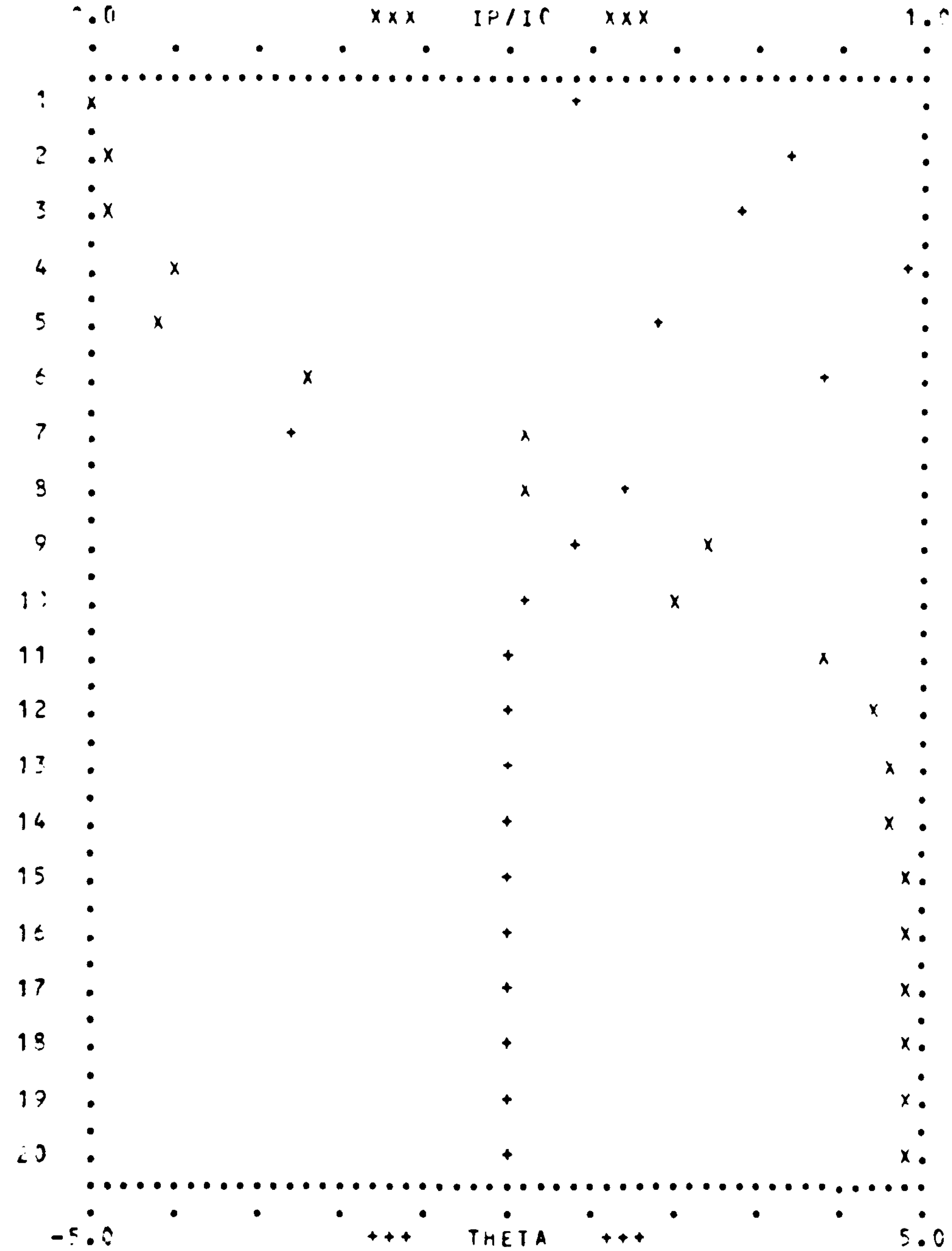

RUN 529. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 2457.60001;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



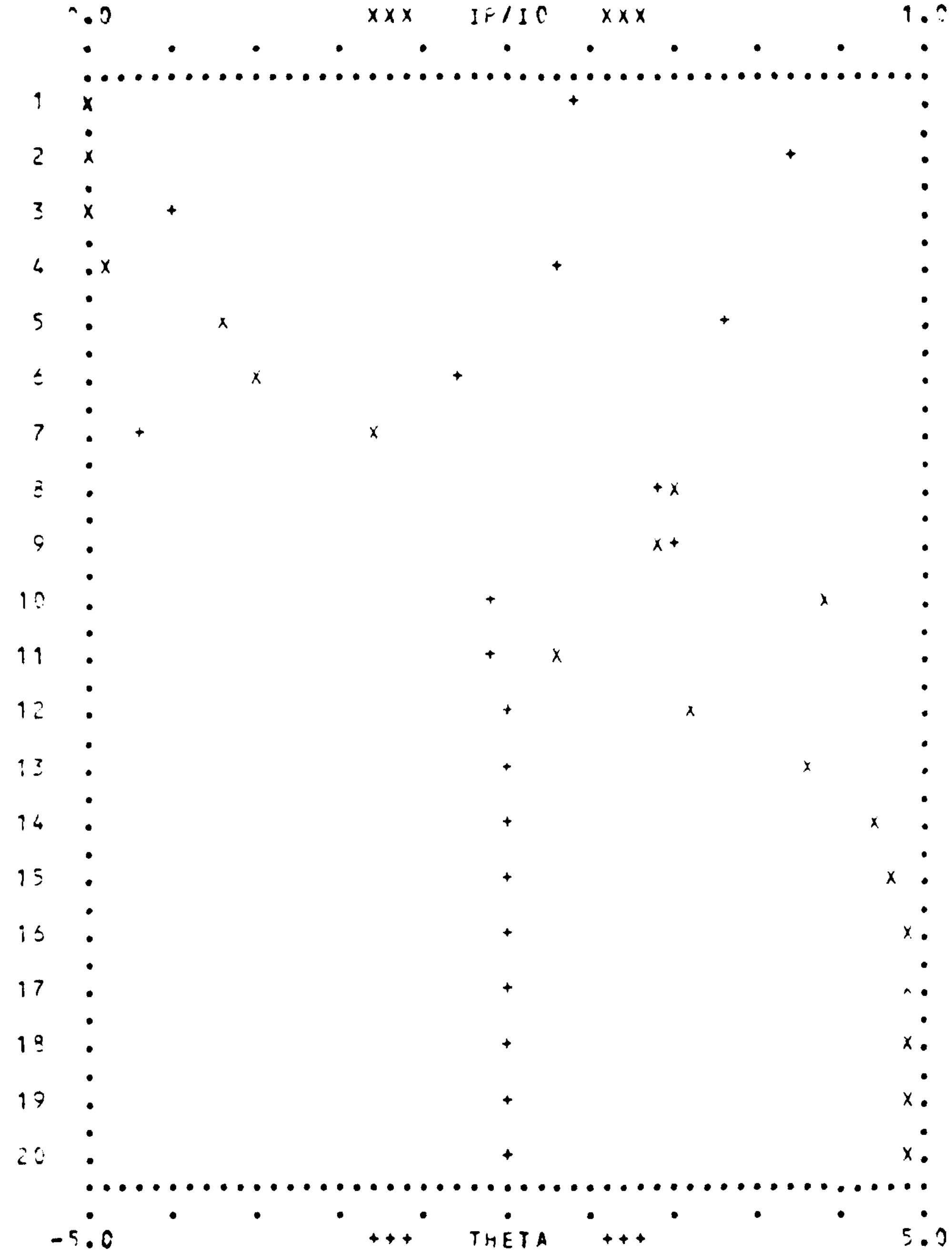

RUN 530. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 4915.20001;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2046.



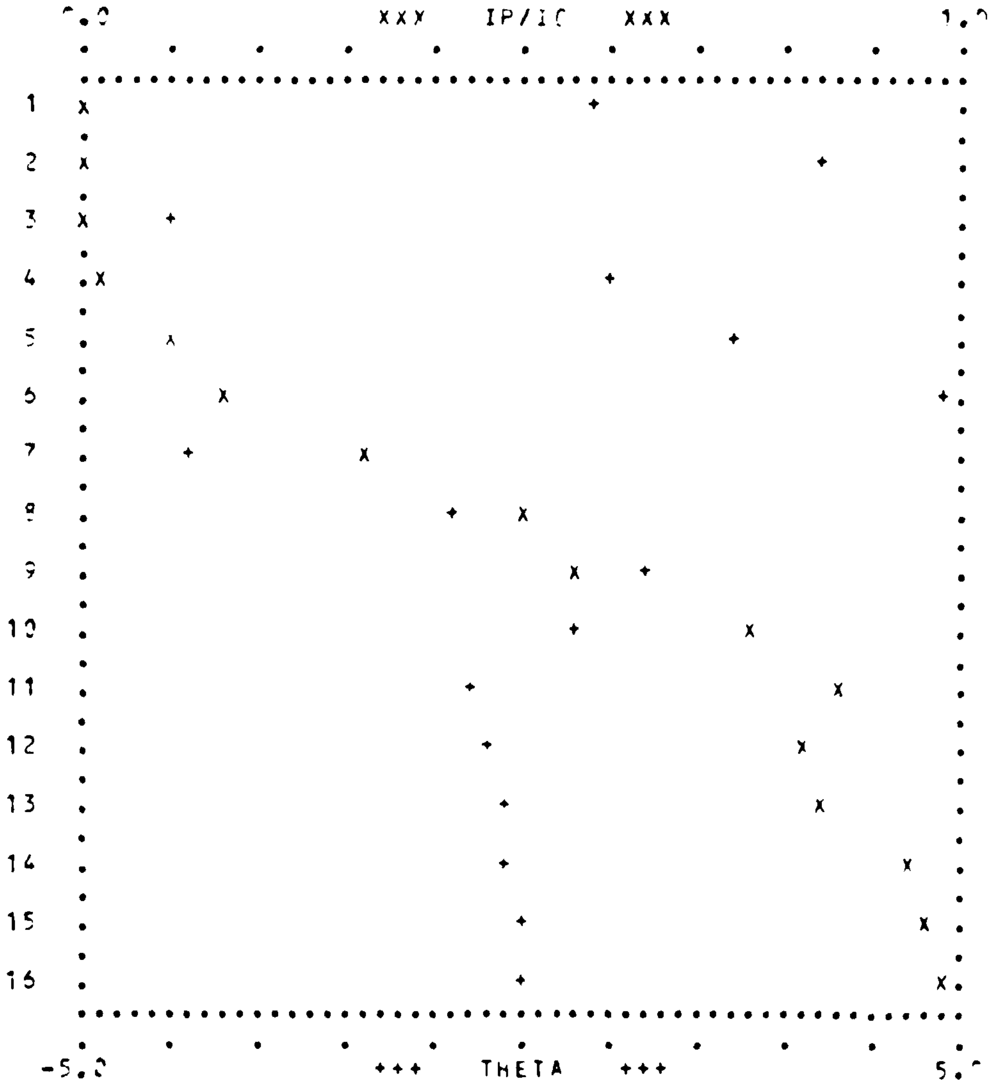

RUN 531. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2045.



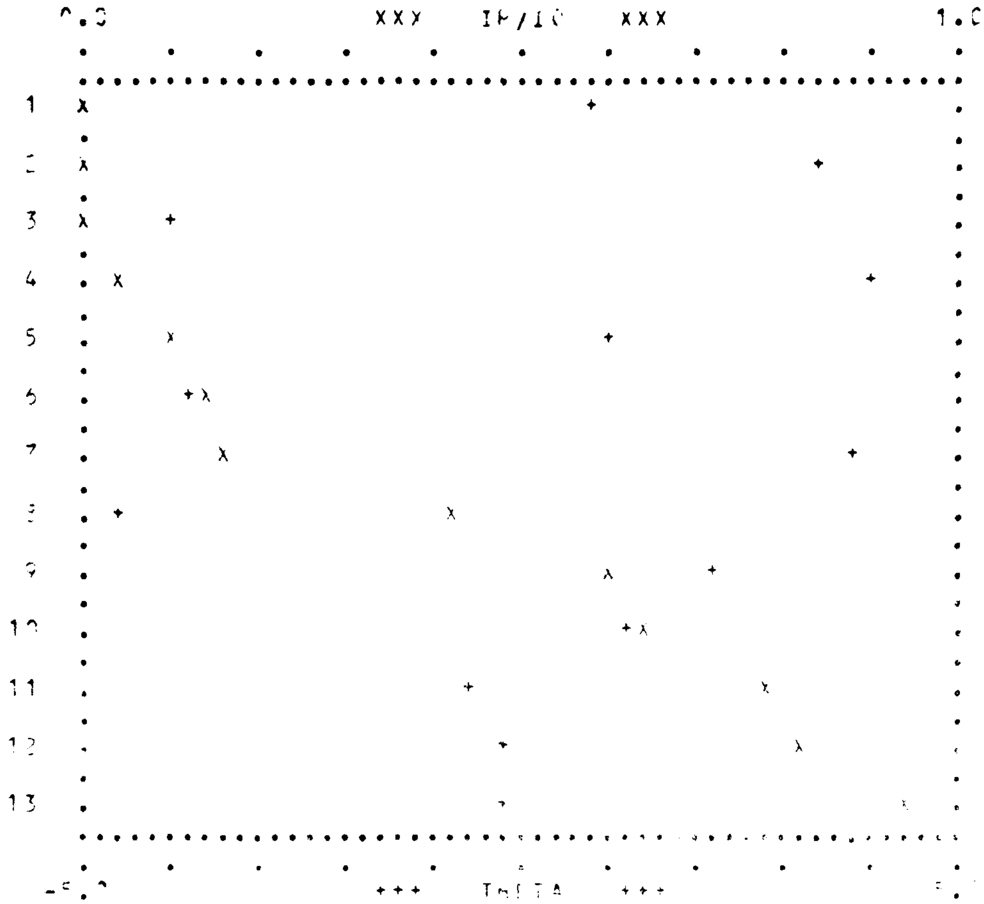

RUN 532. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



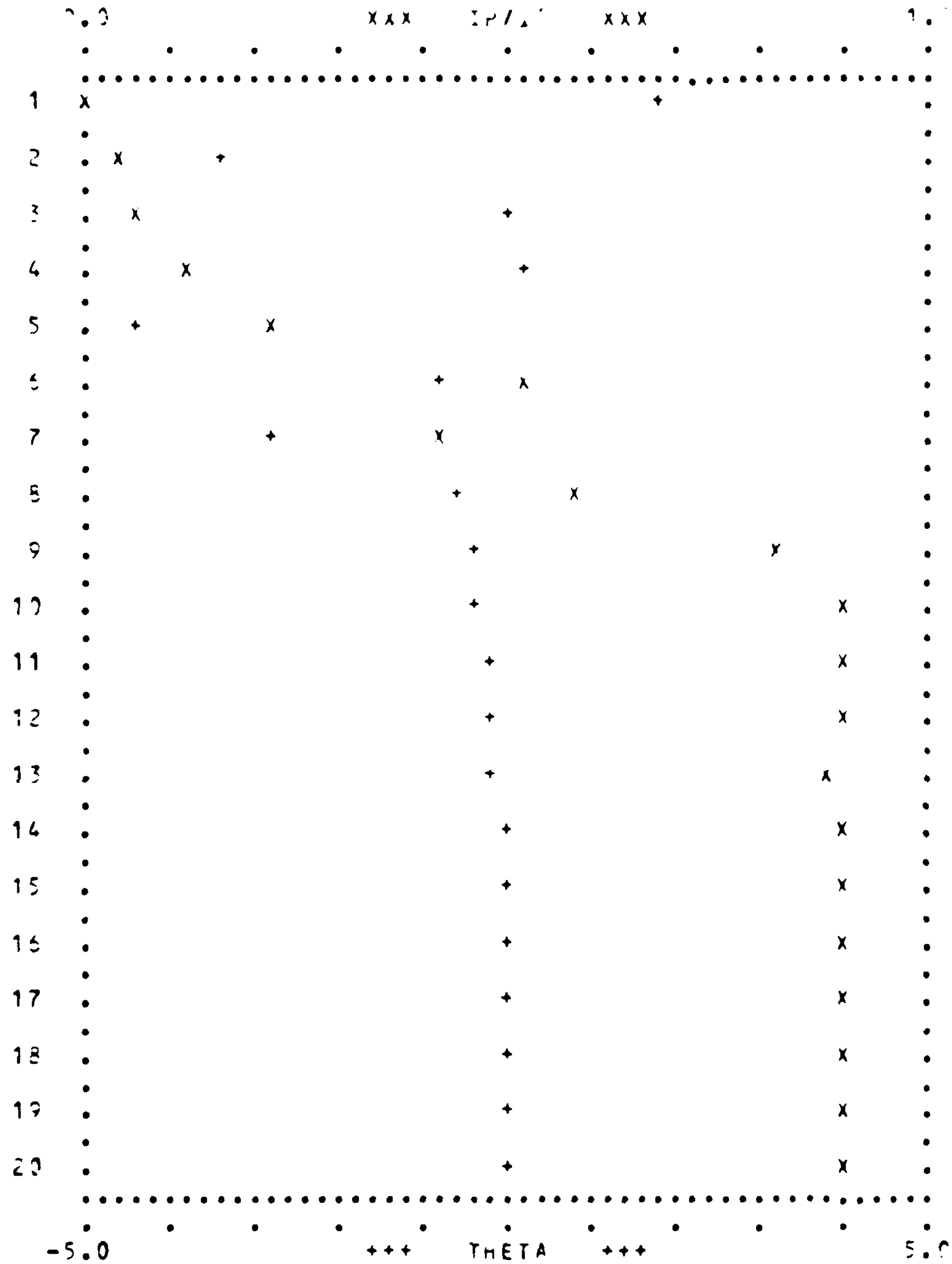

RUN 533. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



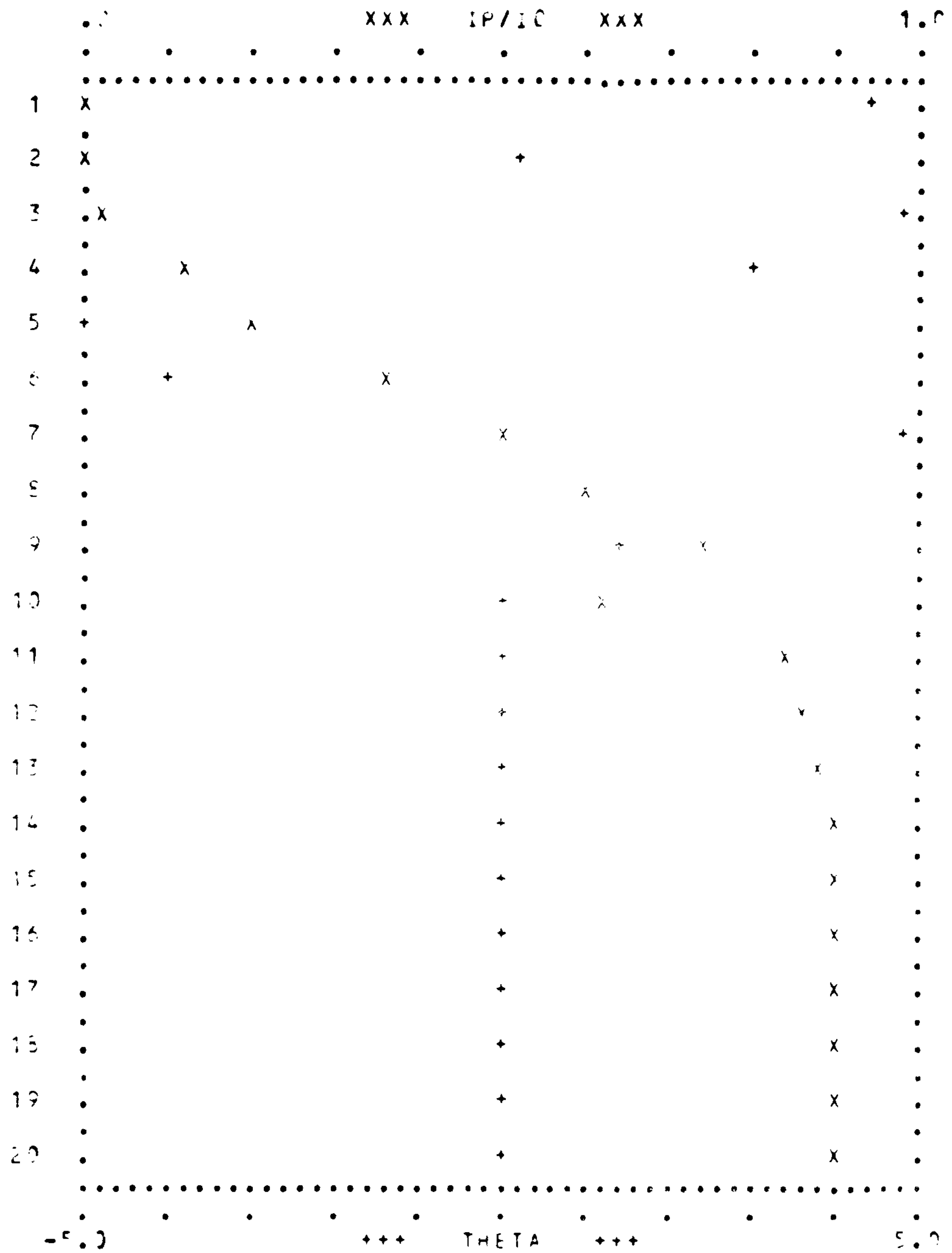

RUN 534. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 2457.60001;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



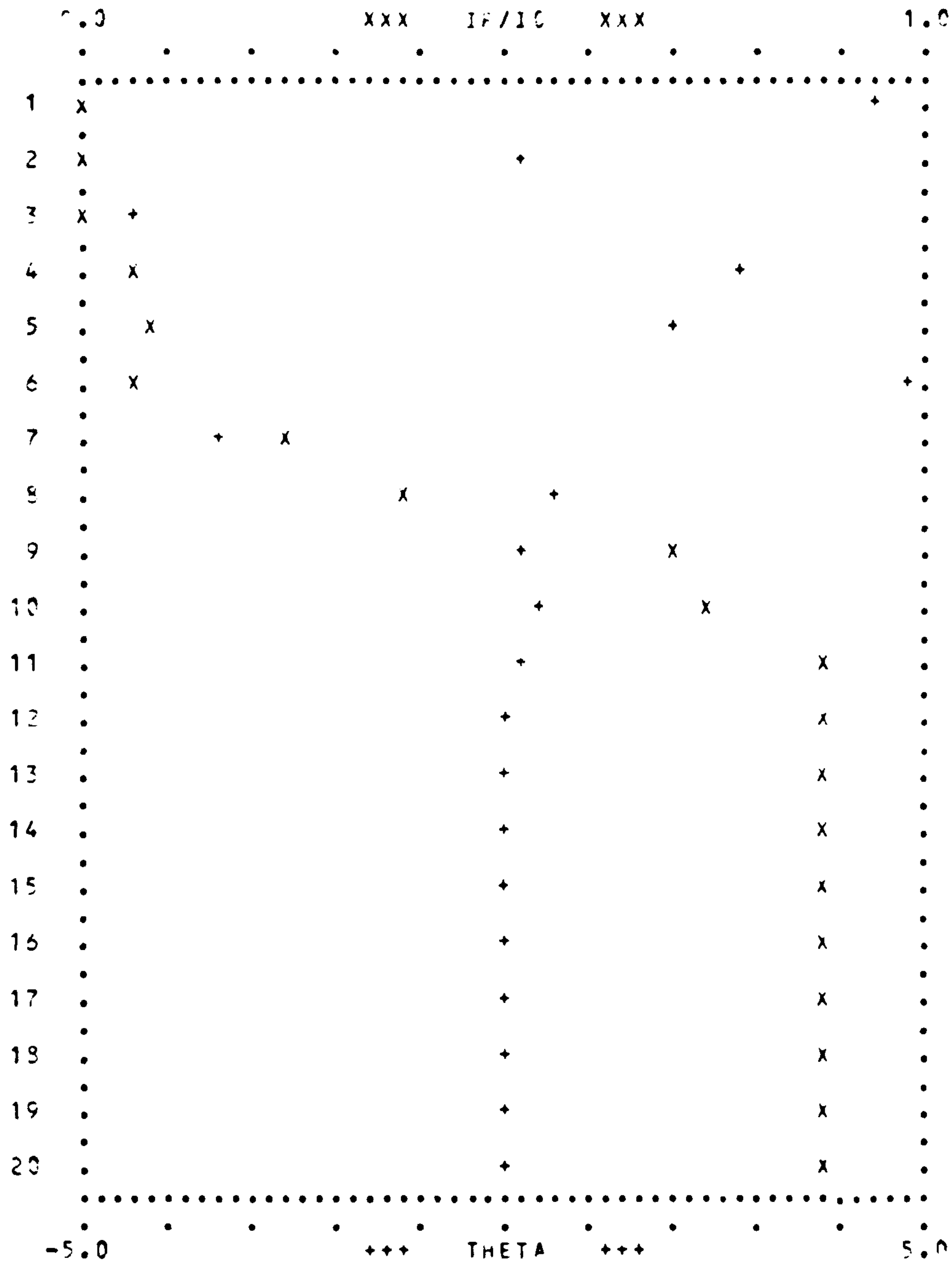

RUN 535. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IF/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 4915.20001;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=2048.



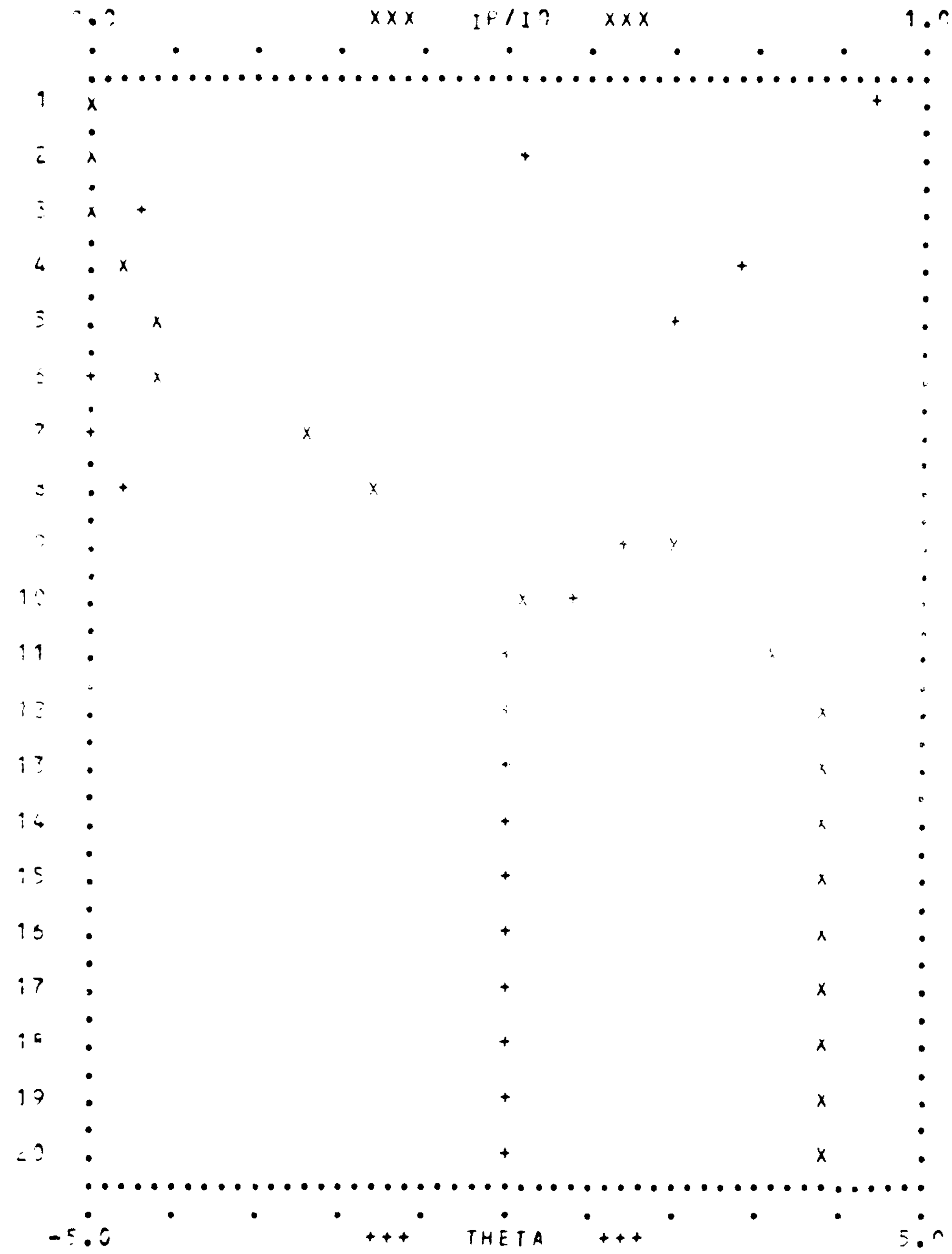

RUN 561. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 507.55500;MAGNIFICATION=1.90001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



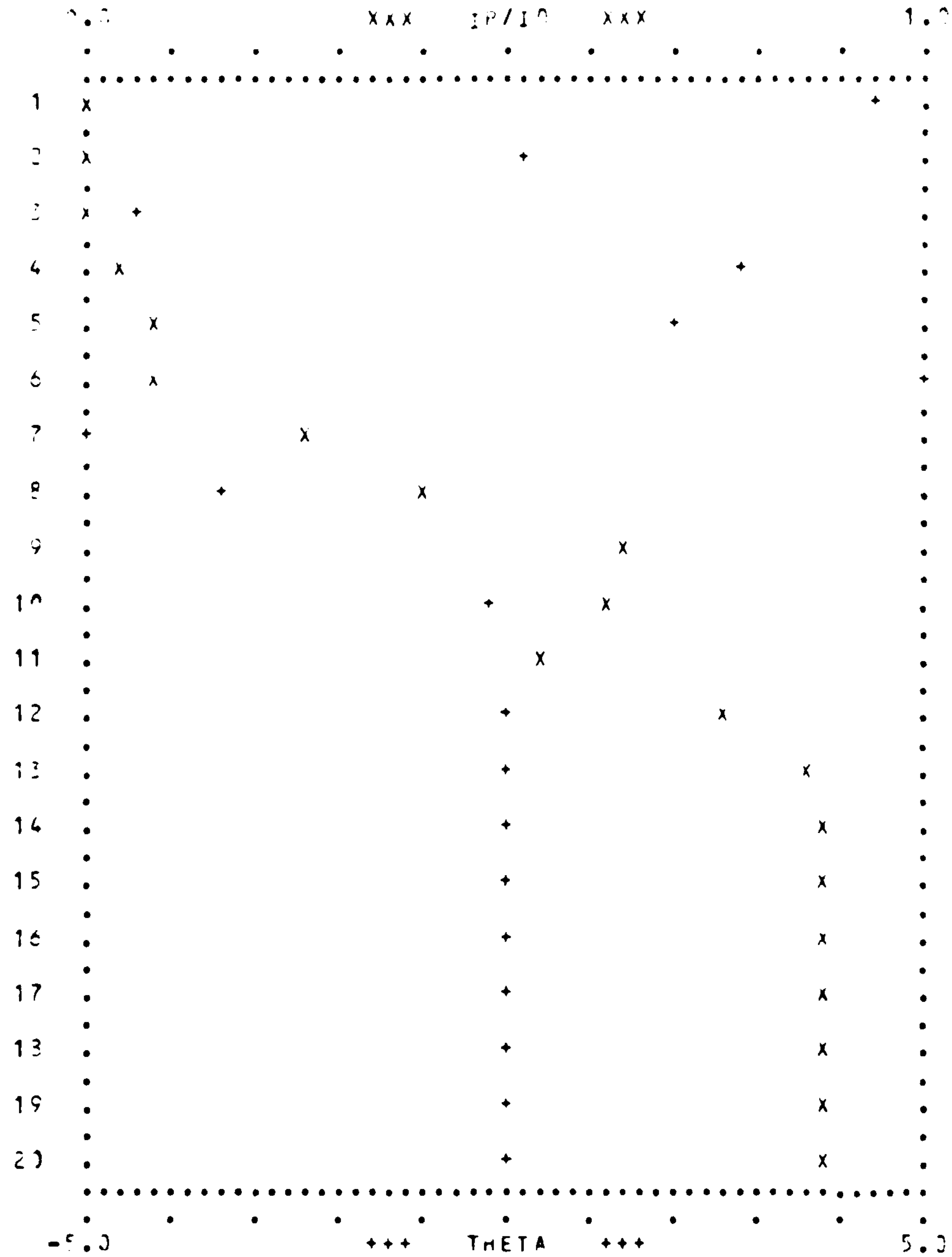
RUN 531. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 507.55500;MAGNIFICATION=1.90001
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=4096.



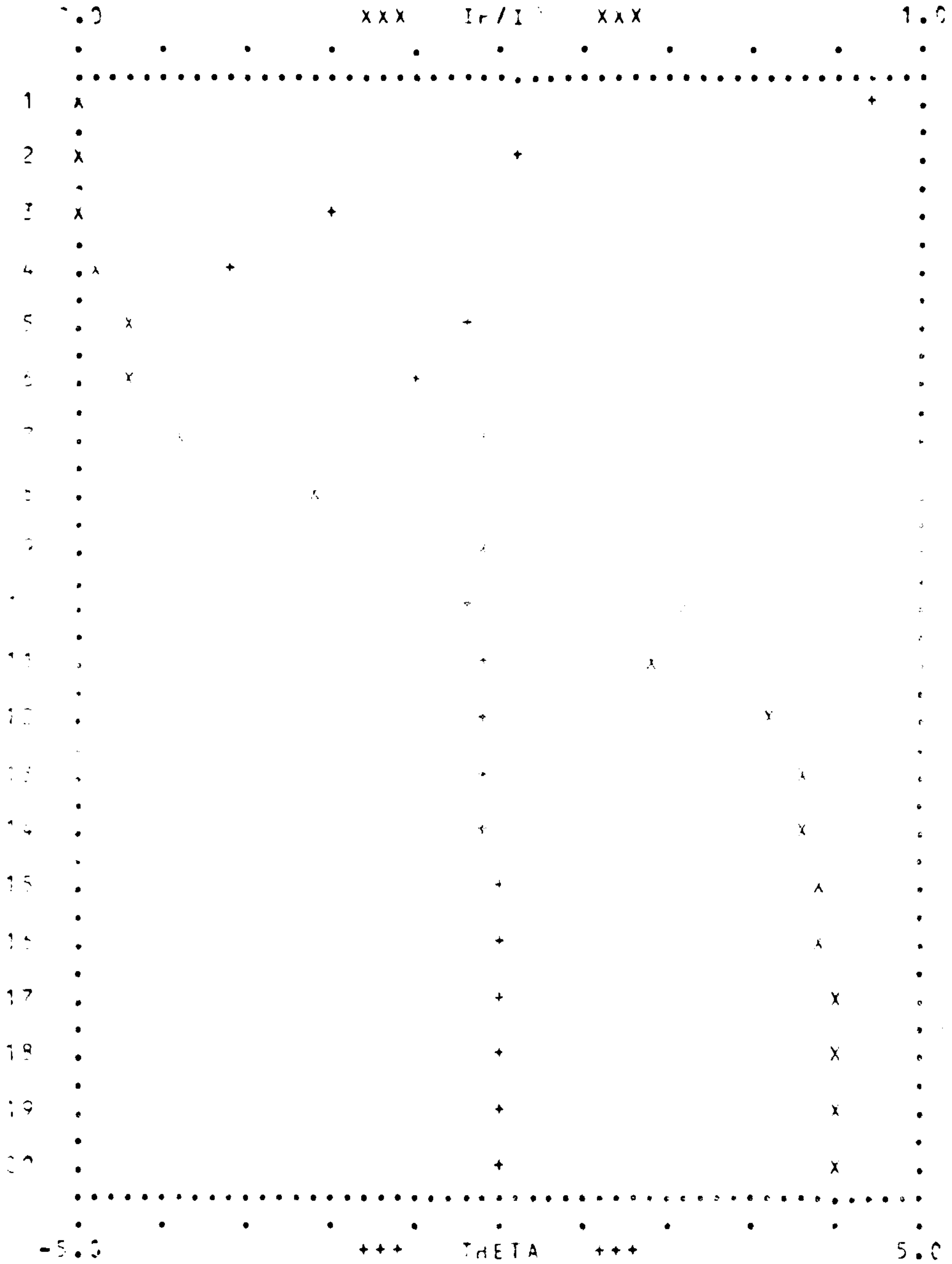

RUN 552. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1008.00000;MAGNIFICATION=1.90001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=4096.



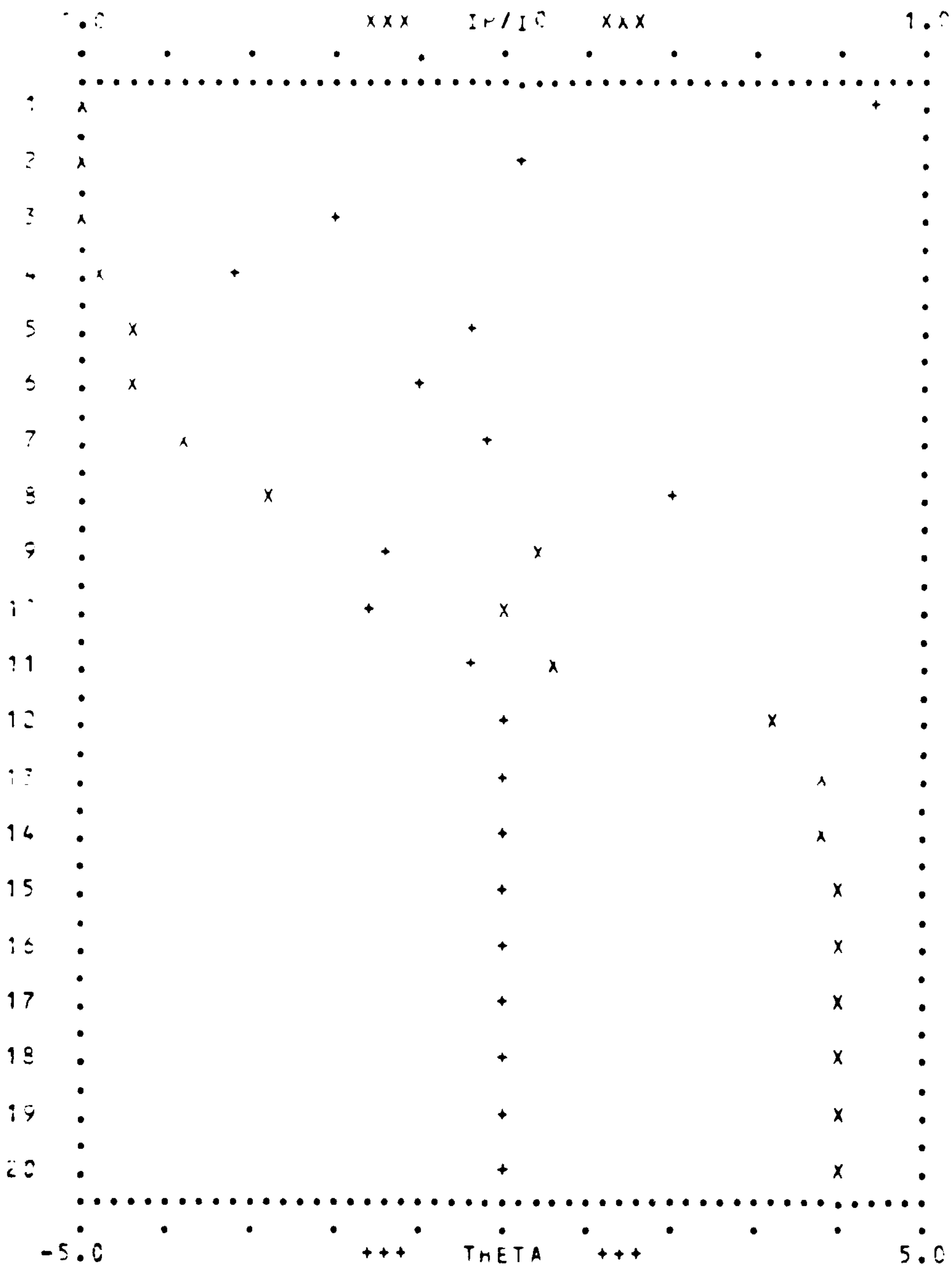

RUN 583. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 1012.44400;MAGNIFICATION=1.90001
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=4096.



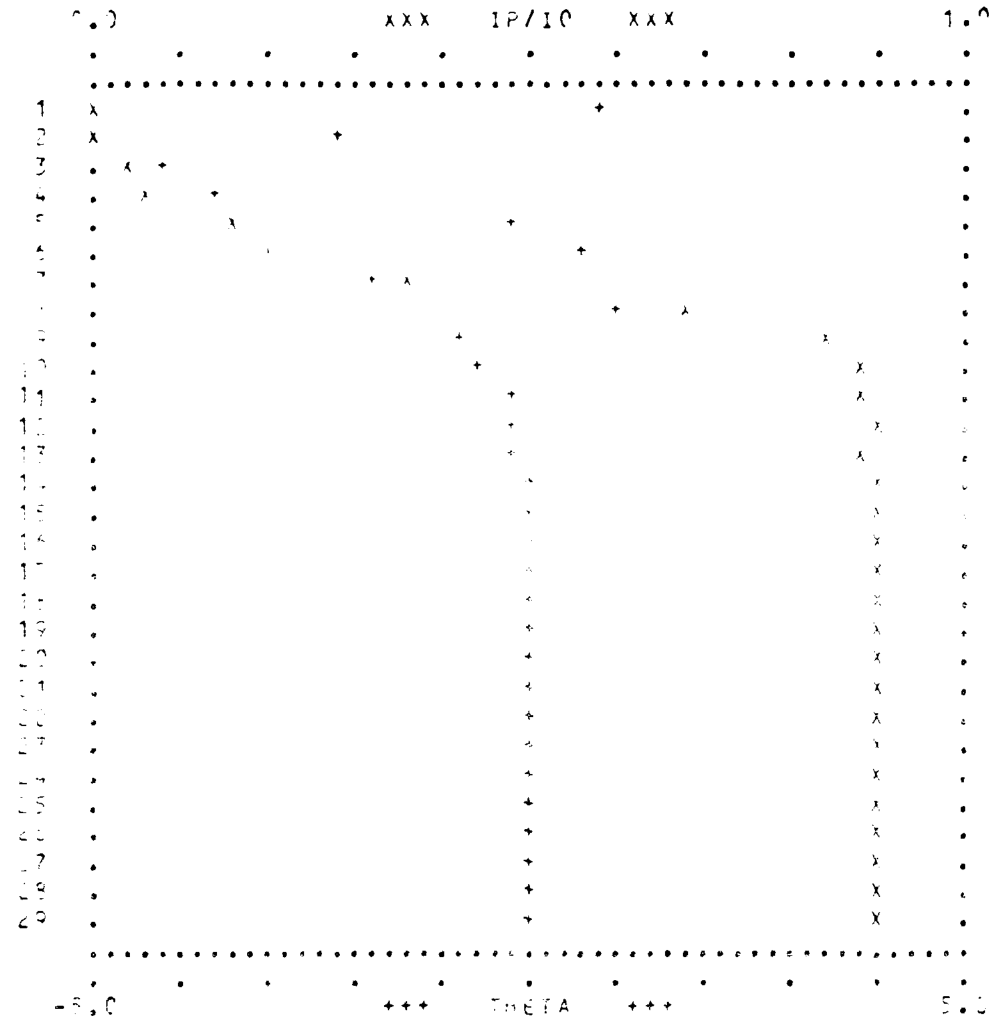

RUN 534. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1016.85500;MAGNIFICATION=1.00001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=4096.



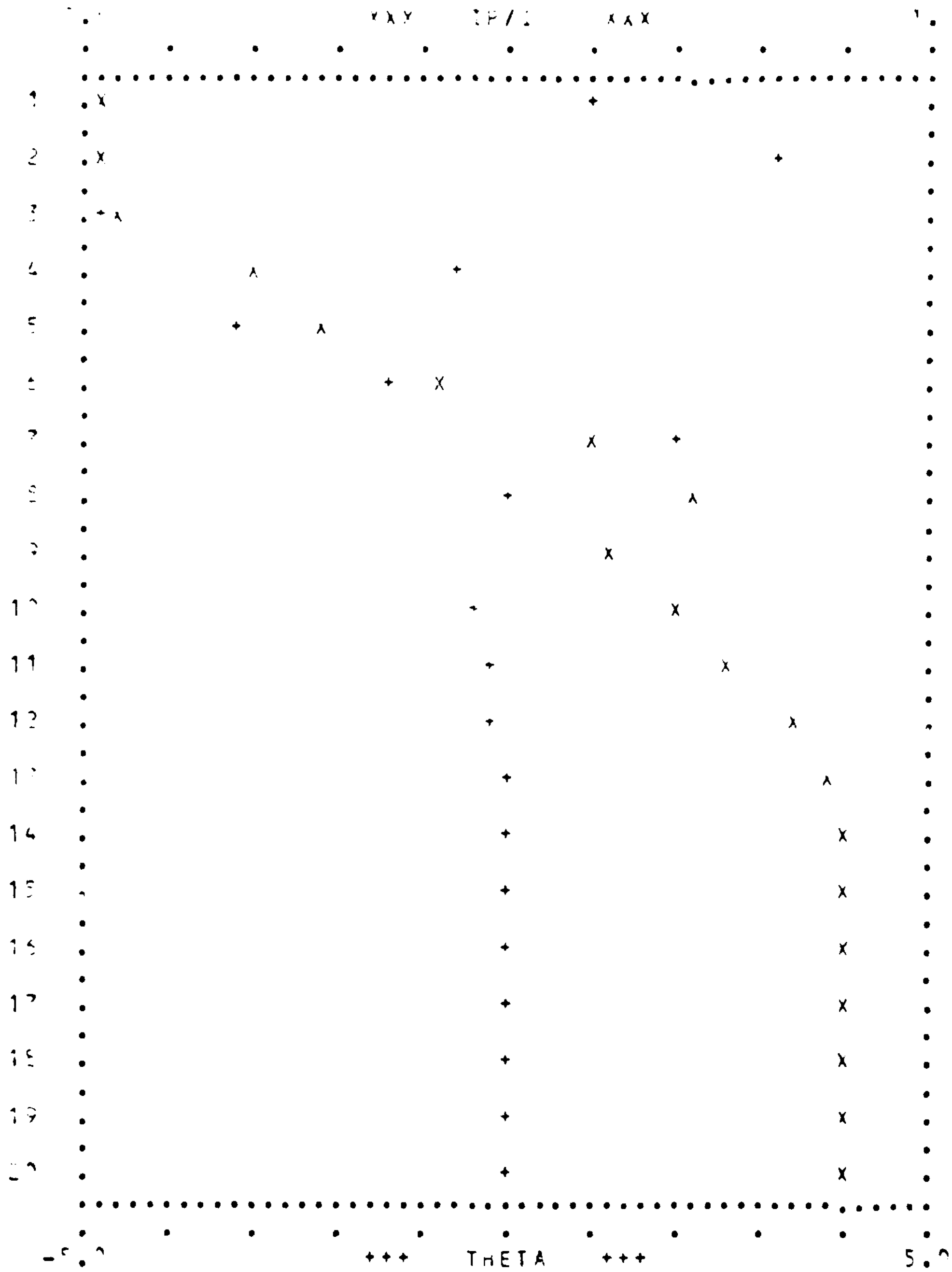
RUN 555. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 2021.33299;MAGNIFICATION=1.90001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=4096.



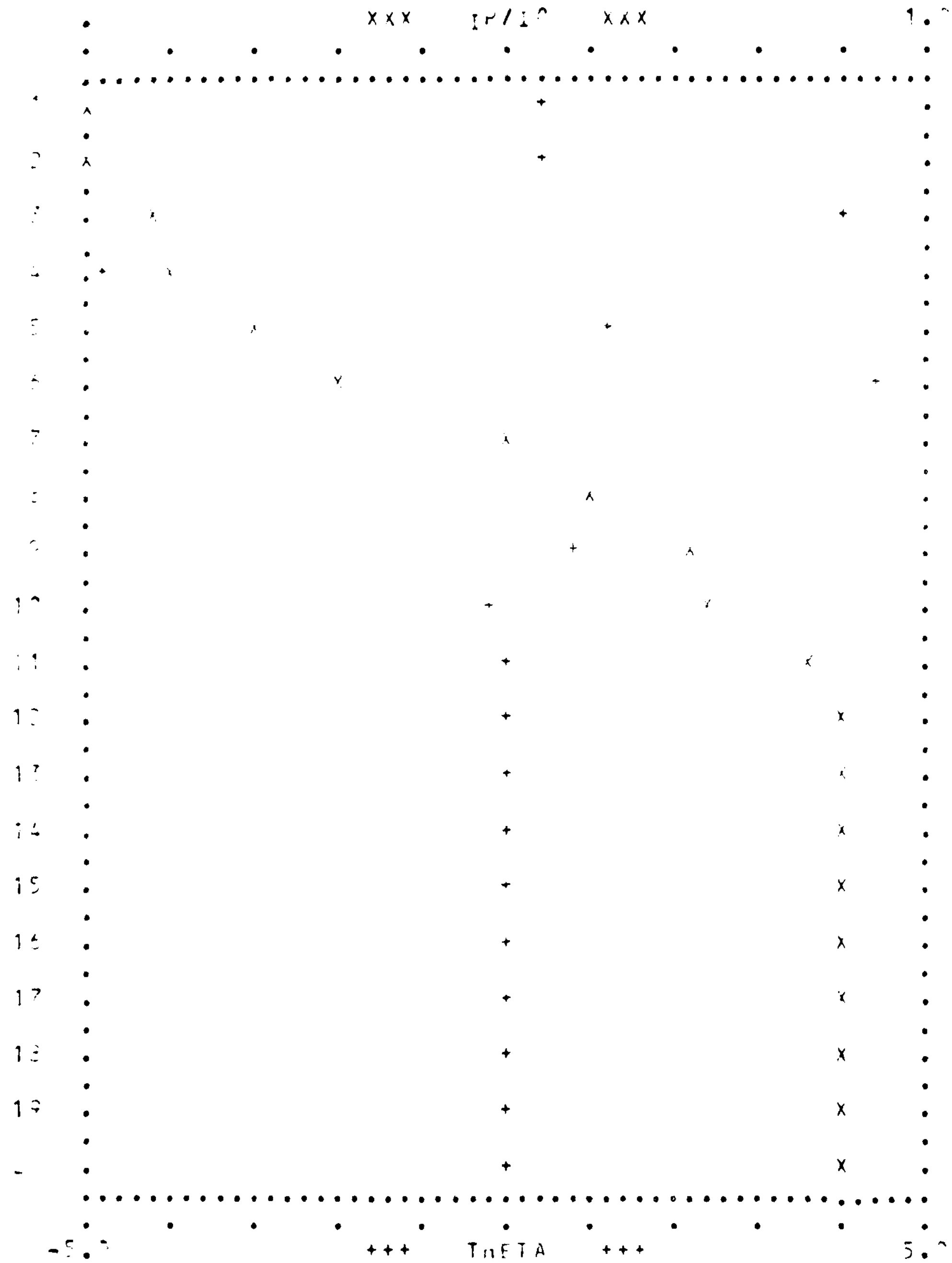

RUN 586. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 2025.77699;MAGNIFICATION=1.90001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=4096.



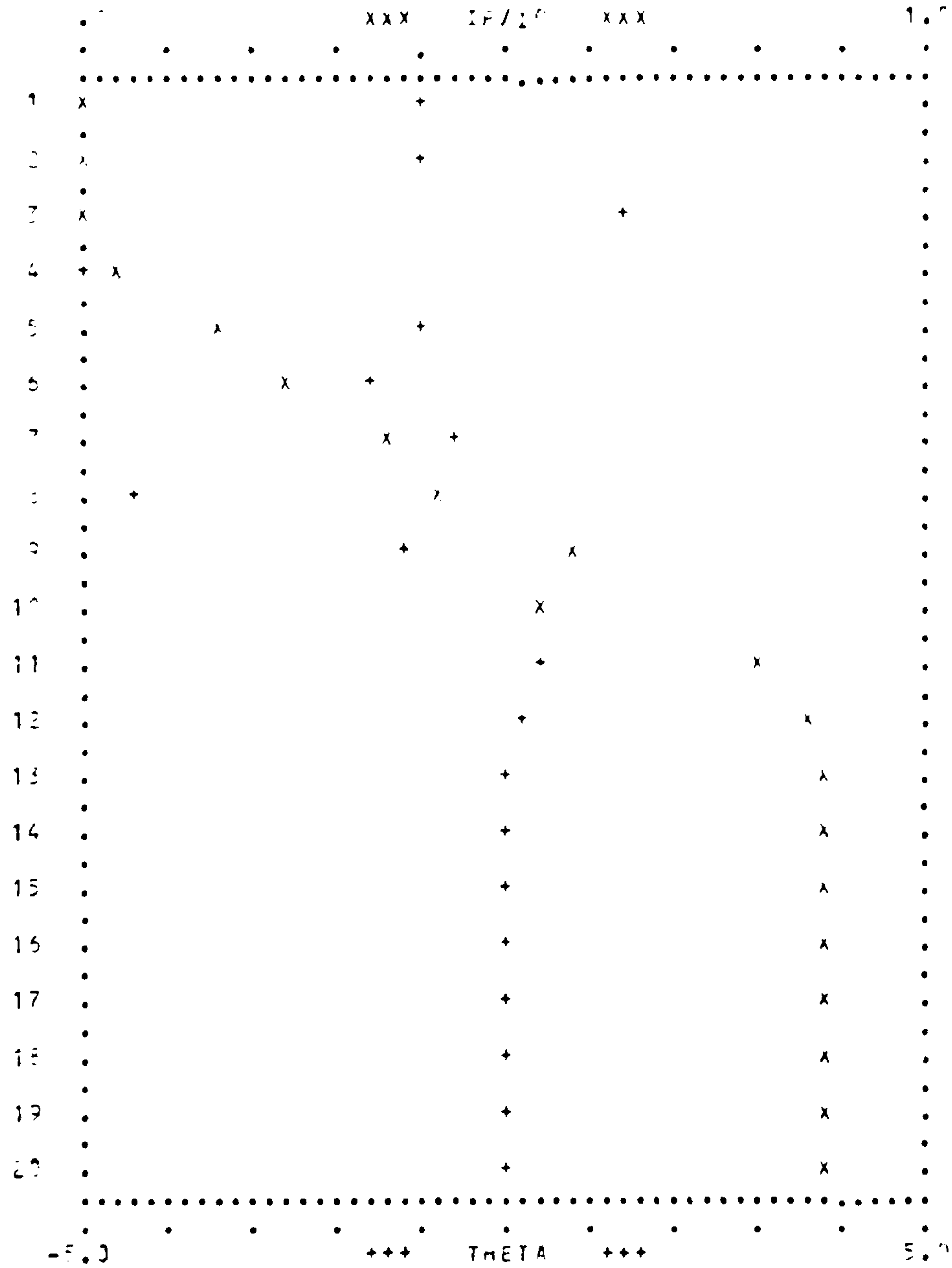

RUN 591. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 507.55500;MAGNIFICATION=1.90001
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=8192.



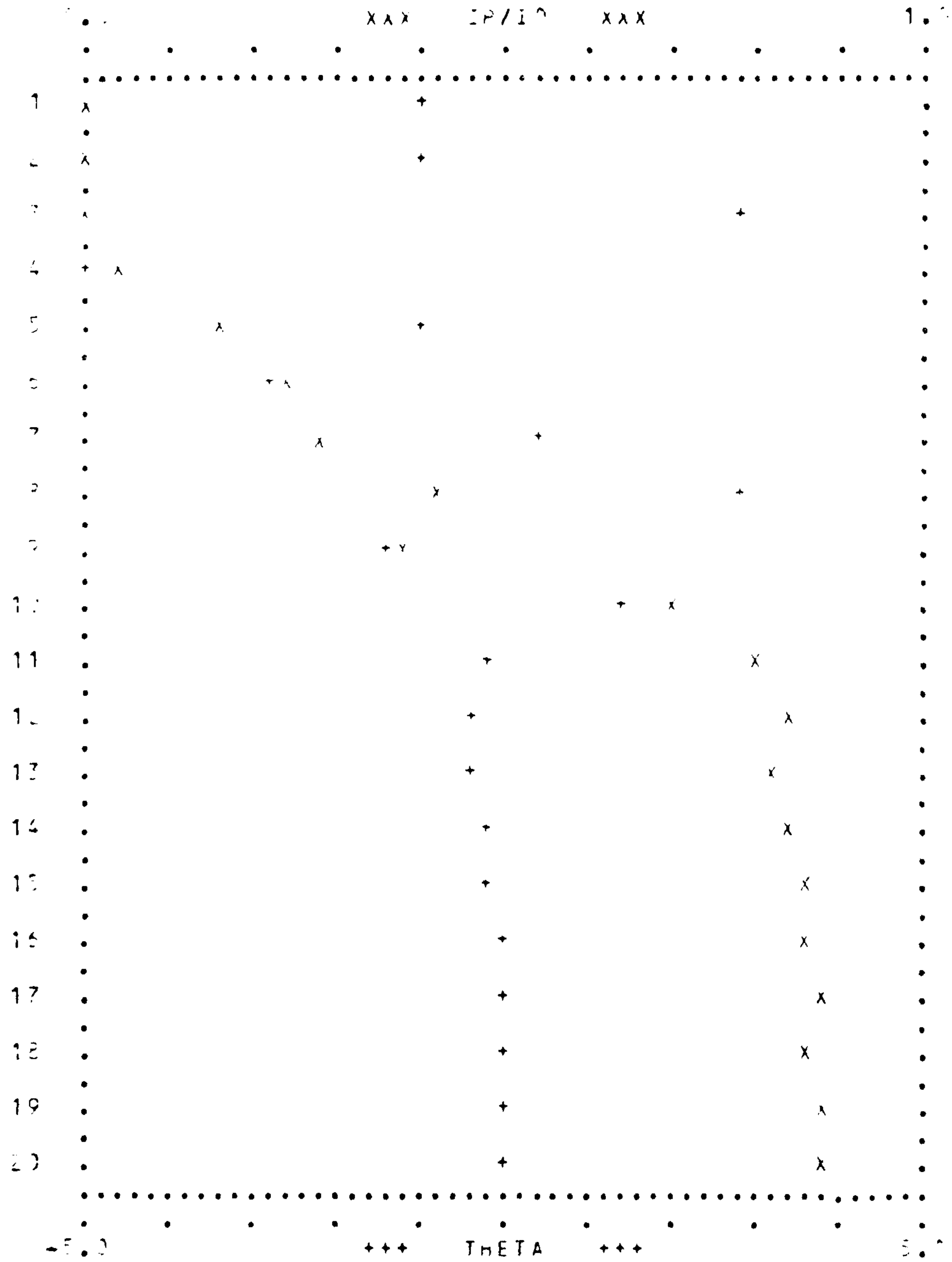

RUN 5.1. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 5[illegible]7.55500;MAGNIFICATION=1.90001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR= 512.



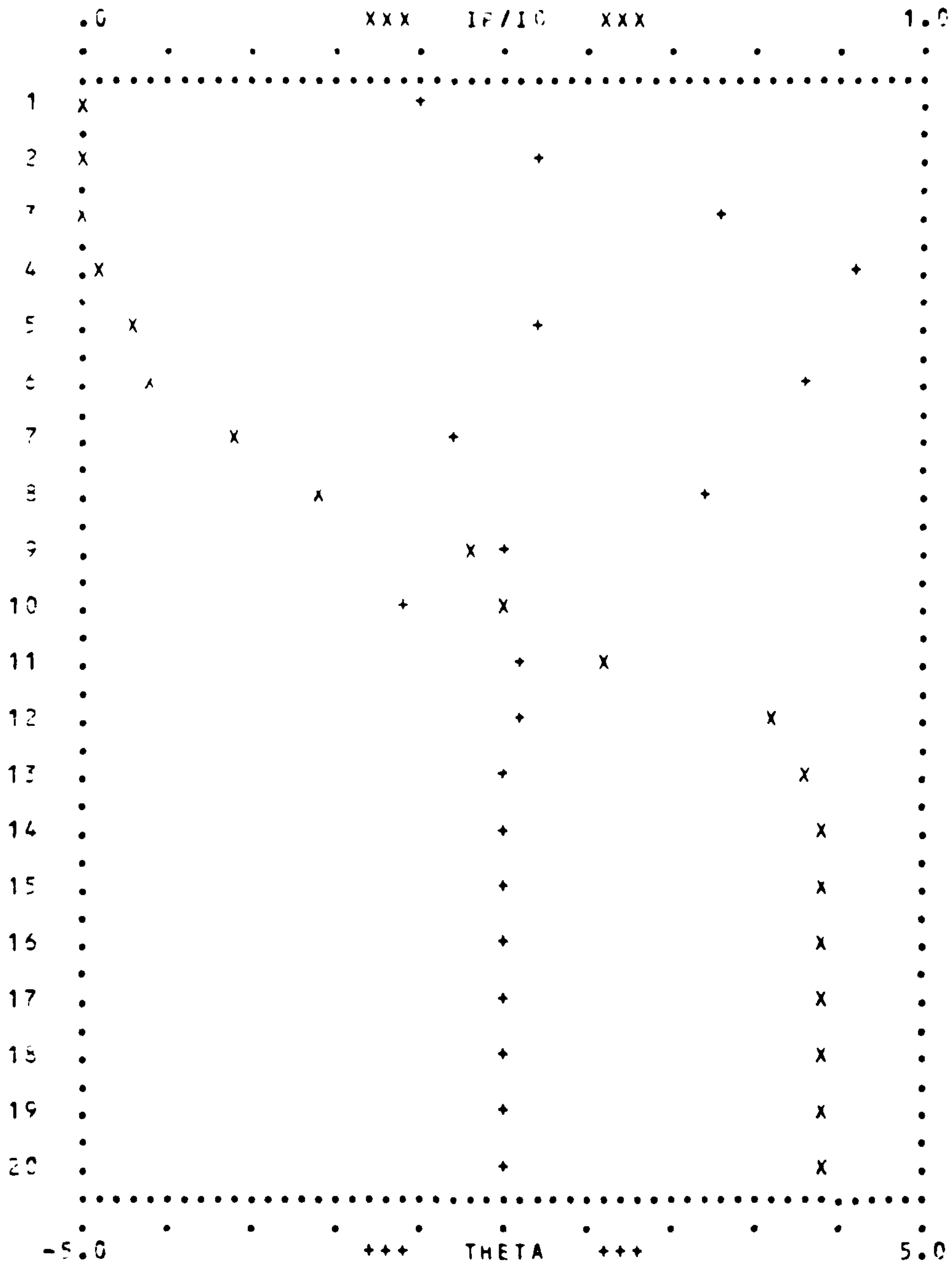

RUN 502. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF 1
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TOTAL FRESNEL NUMBER= 507.55500;MAGNIFICATION=1.00001
ALIGNMENT ERROR= .00000;NO OF MESH POINTS ON MIRROR=5192.



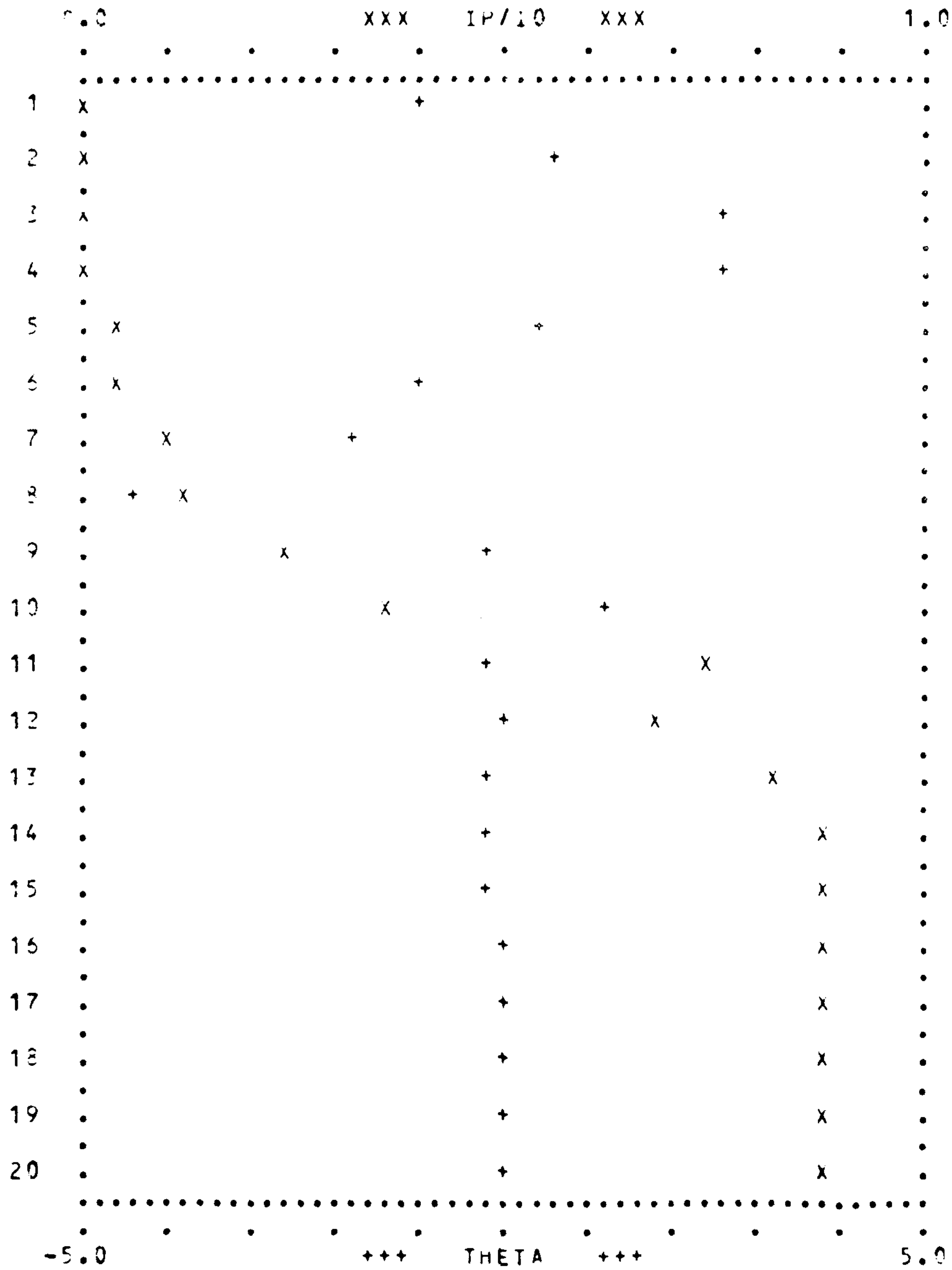
RUN 511. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IF/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1008.00000;MAGNIFICATION=1.90001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=8192.



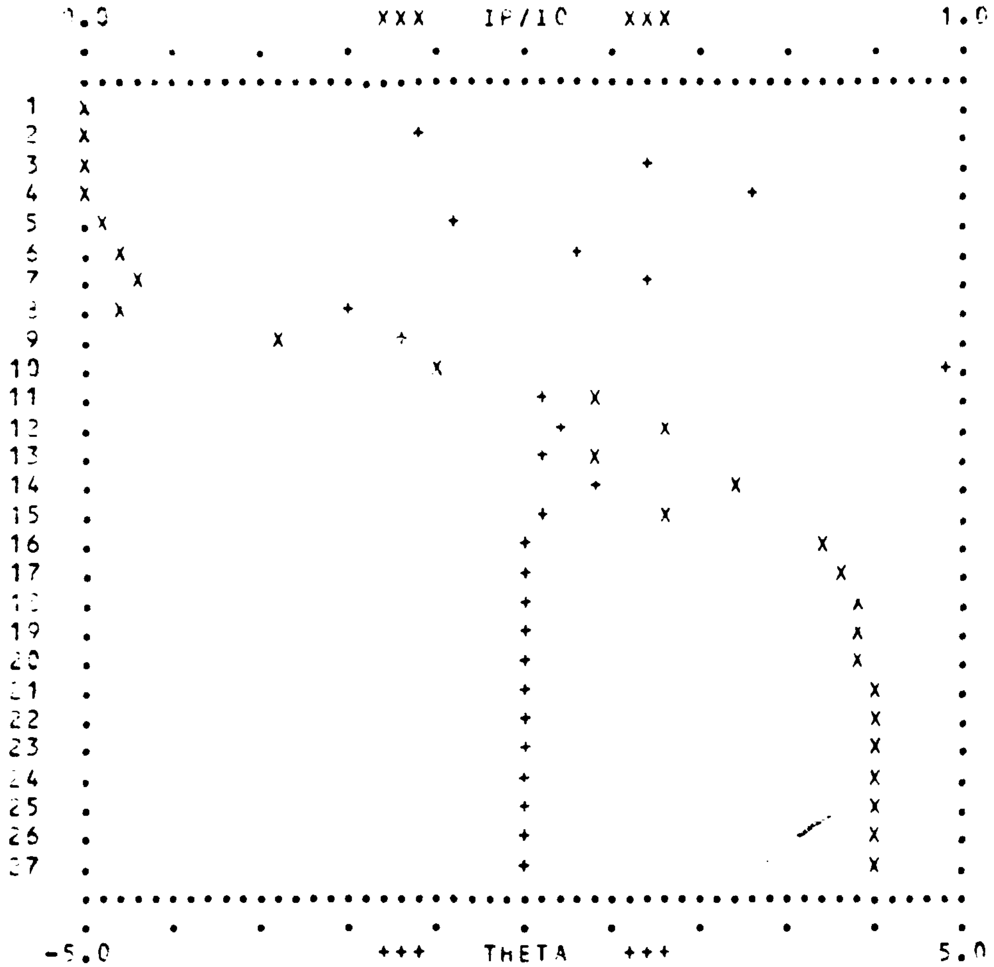

RUN 512. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1012.44400;MAGNIFICATION=1.00001 ALIGNMENT ERROR= .00000;NO OF MESH POINTS ON MIRROR=8192.



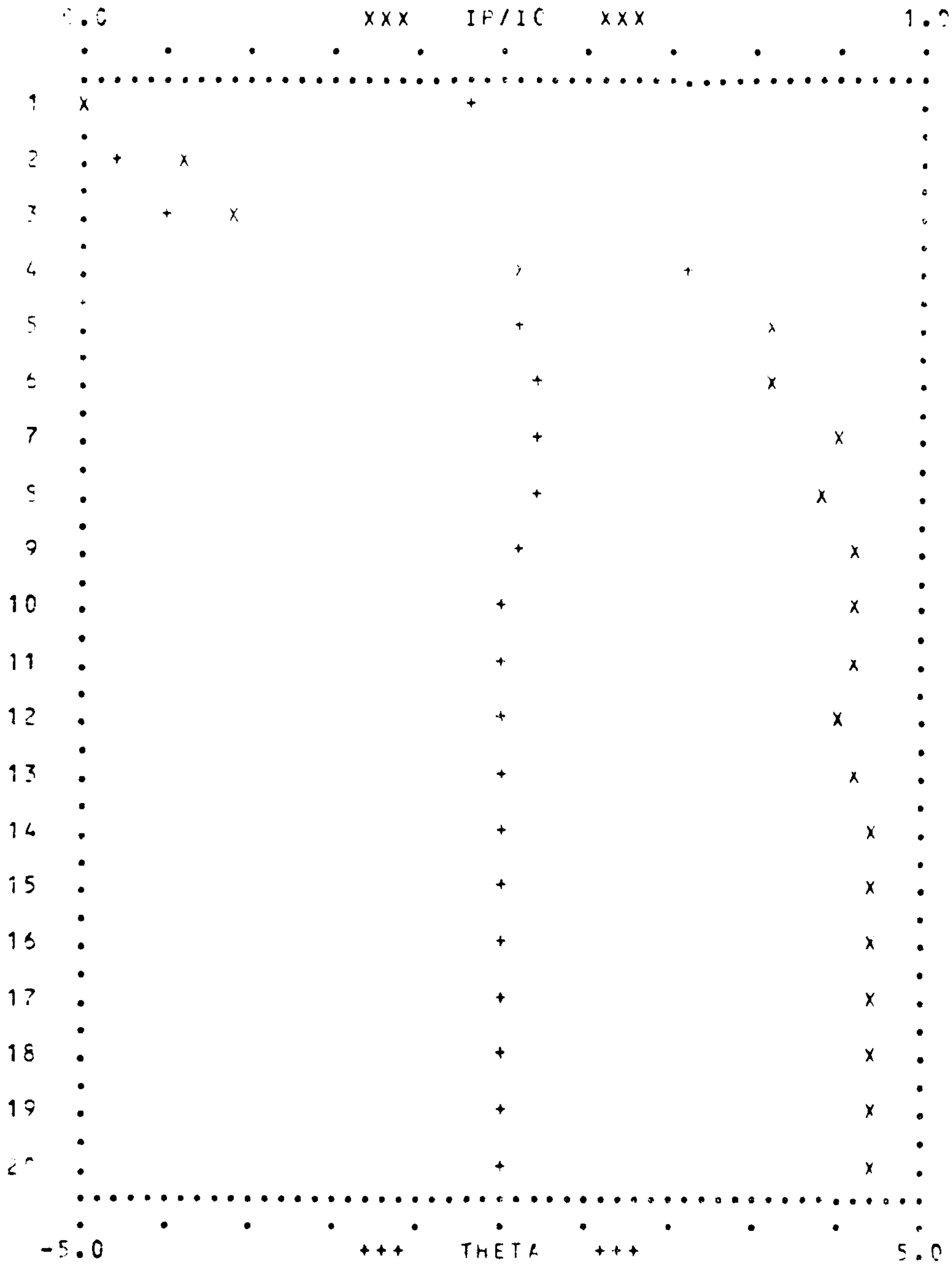
RUN 621. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IF/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 2021.33299;MAGNIFICATION=1.90001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=8192.



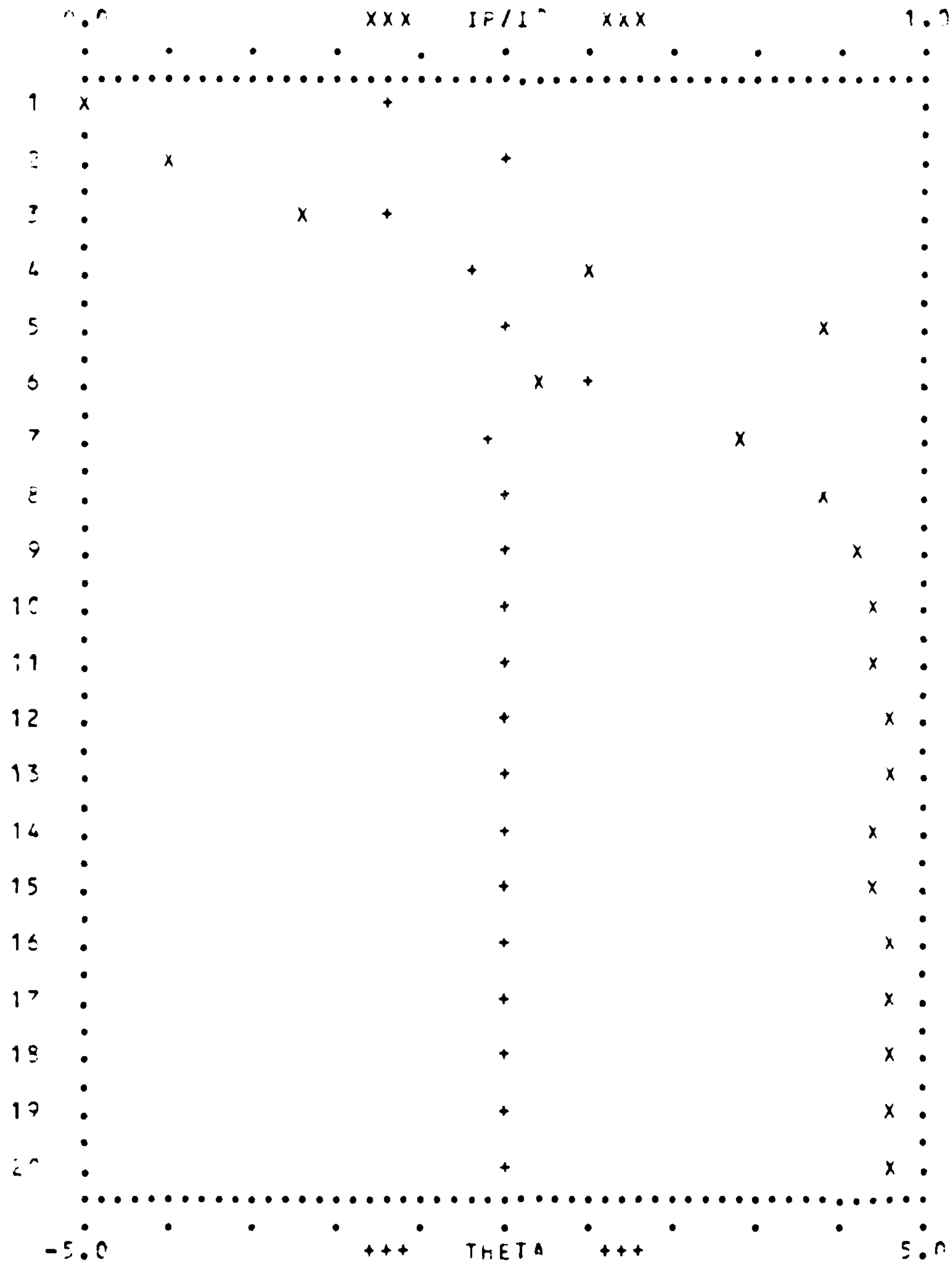

RUN 622. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 4048.00000;MAGNIFICATION=1.90001
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=8192.



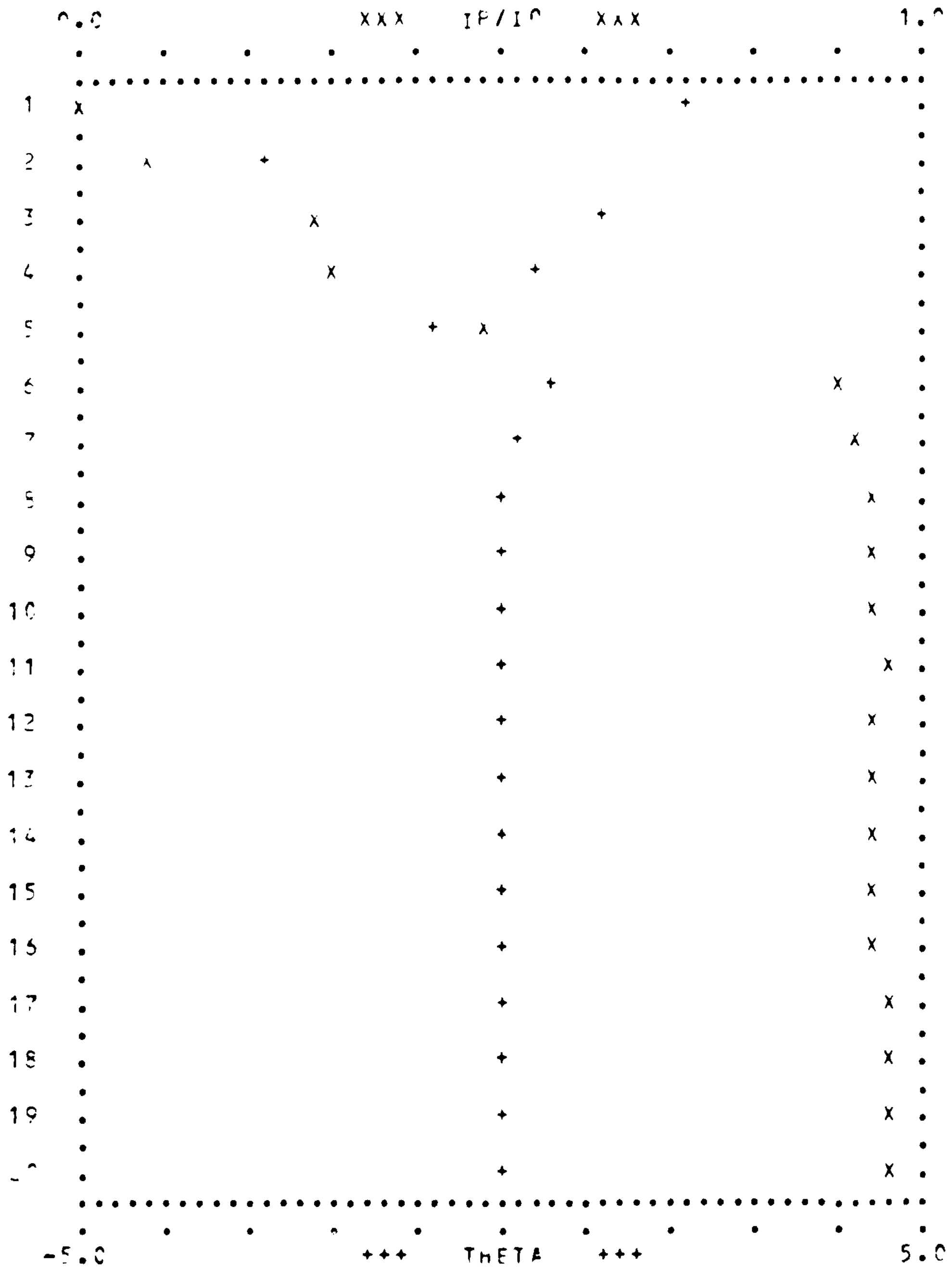
RUN 623. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 8083.55548;MAGNIFICATION=1.00001 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=8192.



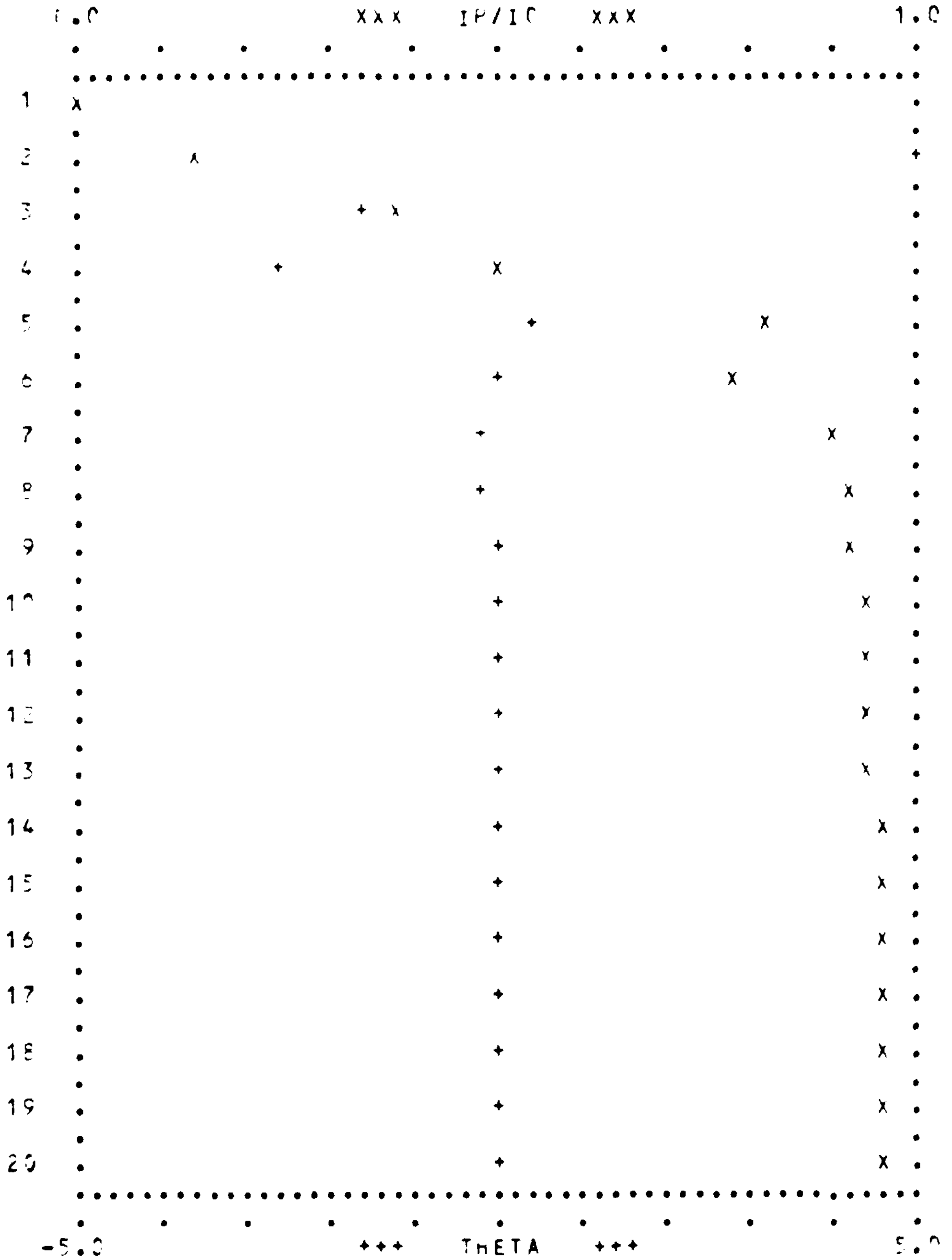

RUN 631. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



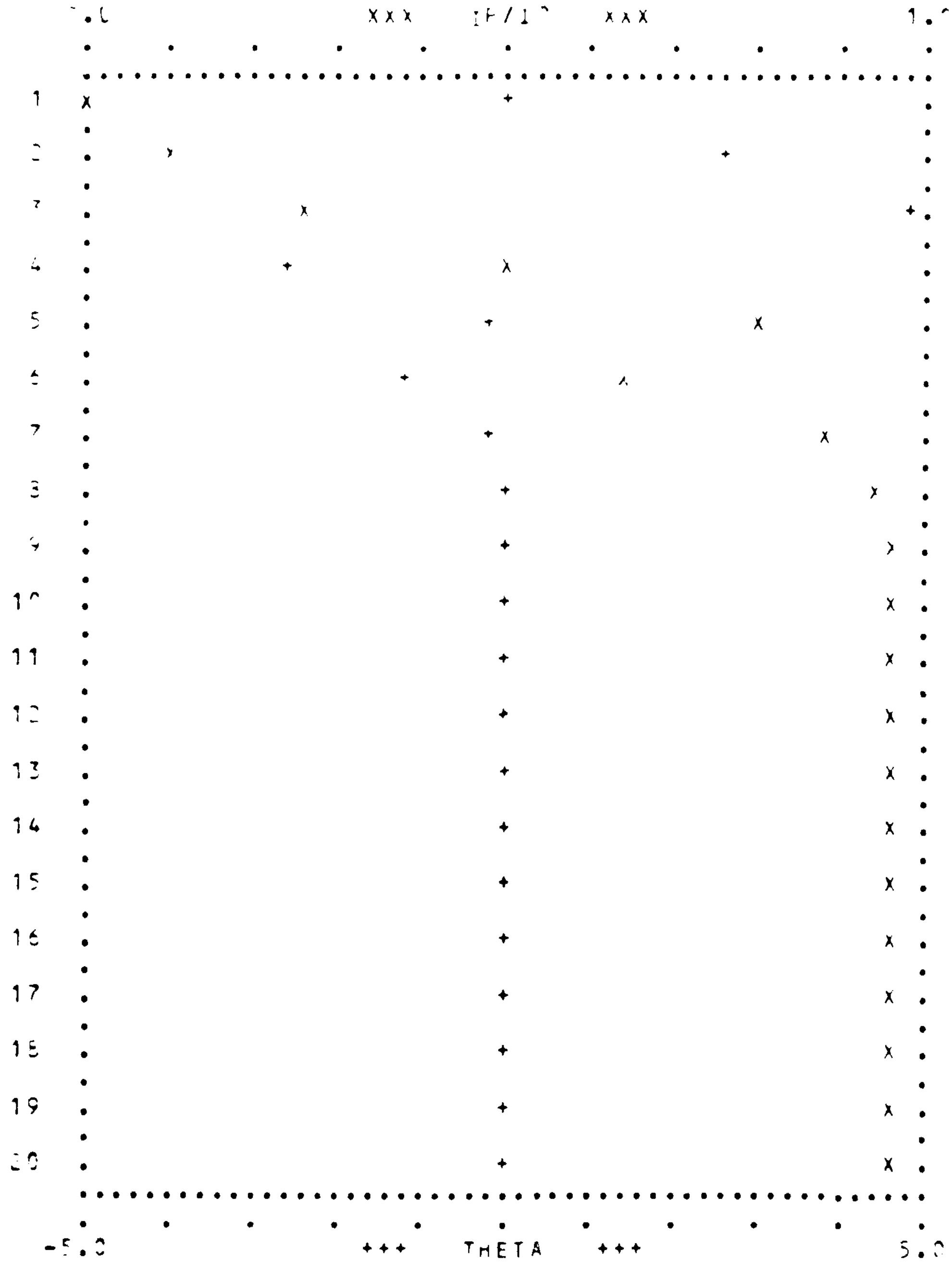

RUN 632. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.




RUN 633. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00000
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



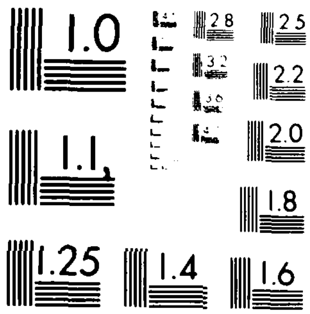

RUN 634. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



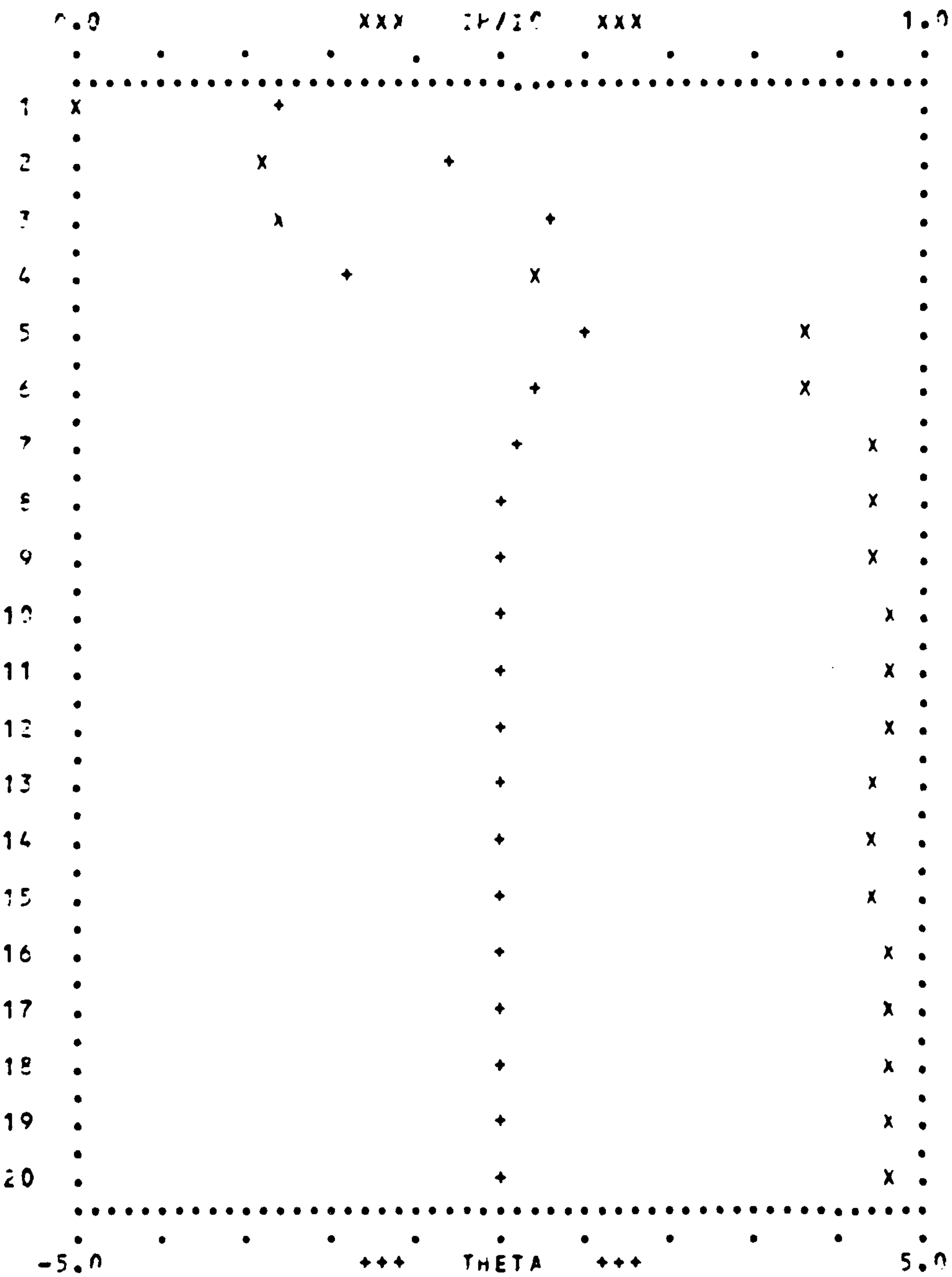

RUN 635. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=[illegible].00000 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.

AD-A131 887 WAVE OPTICS INVESTIGATIONS OF TRANSVERSE MODE FORMATION (U) ARMY MISSILE COMMAND REDSTONE ARSENAL AL DIRECTED ENERGY DIRECTORATE R W JONES ET AL. MAR 82 3/3

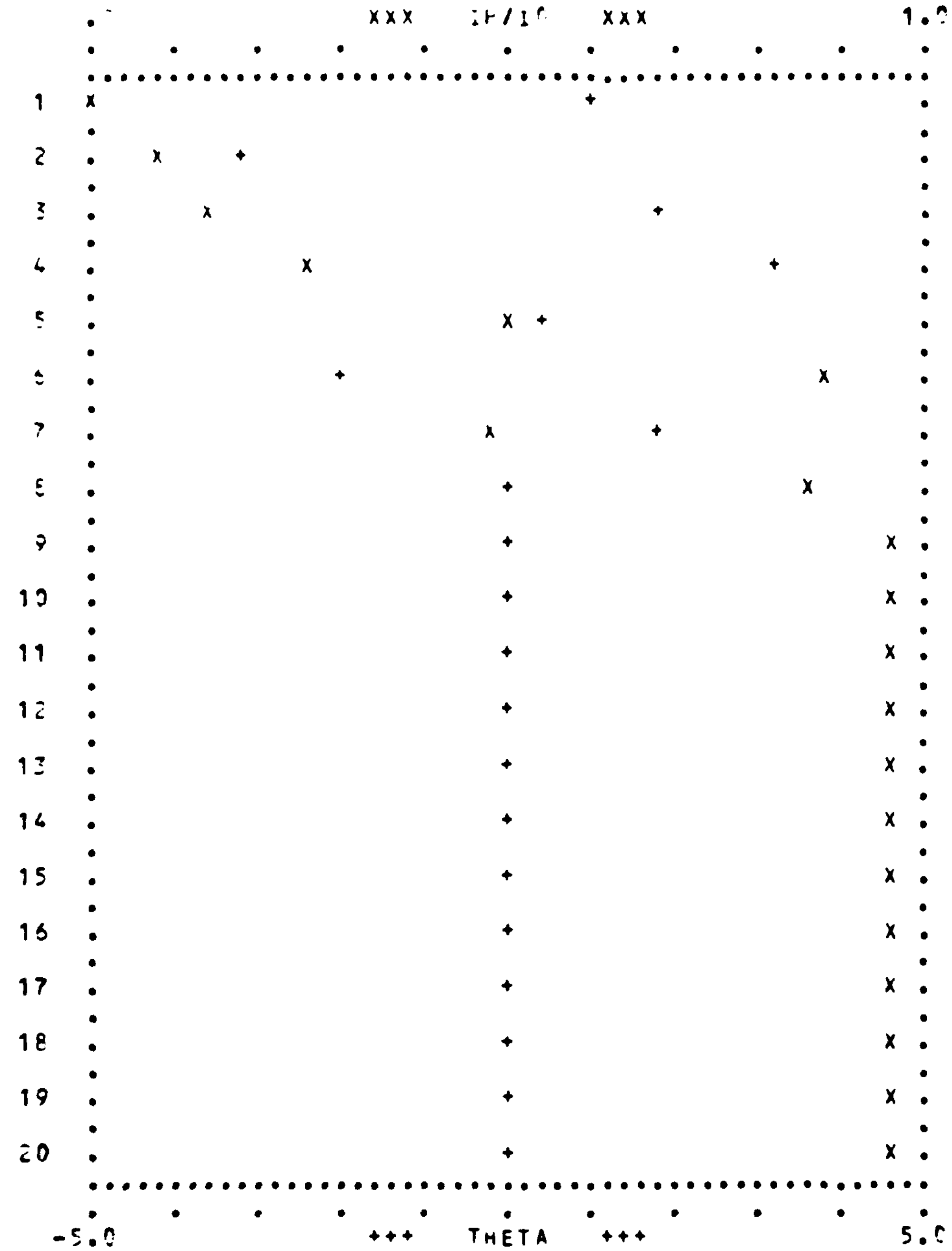
UNCLASSIFIED DRSMI/RH-82-4-TR SBI-AD-E950 422 F/G 20/5 NL



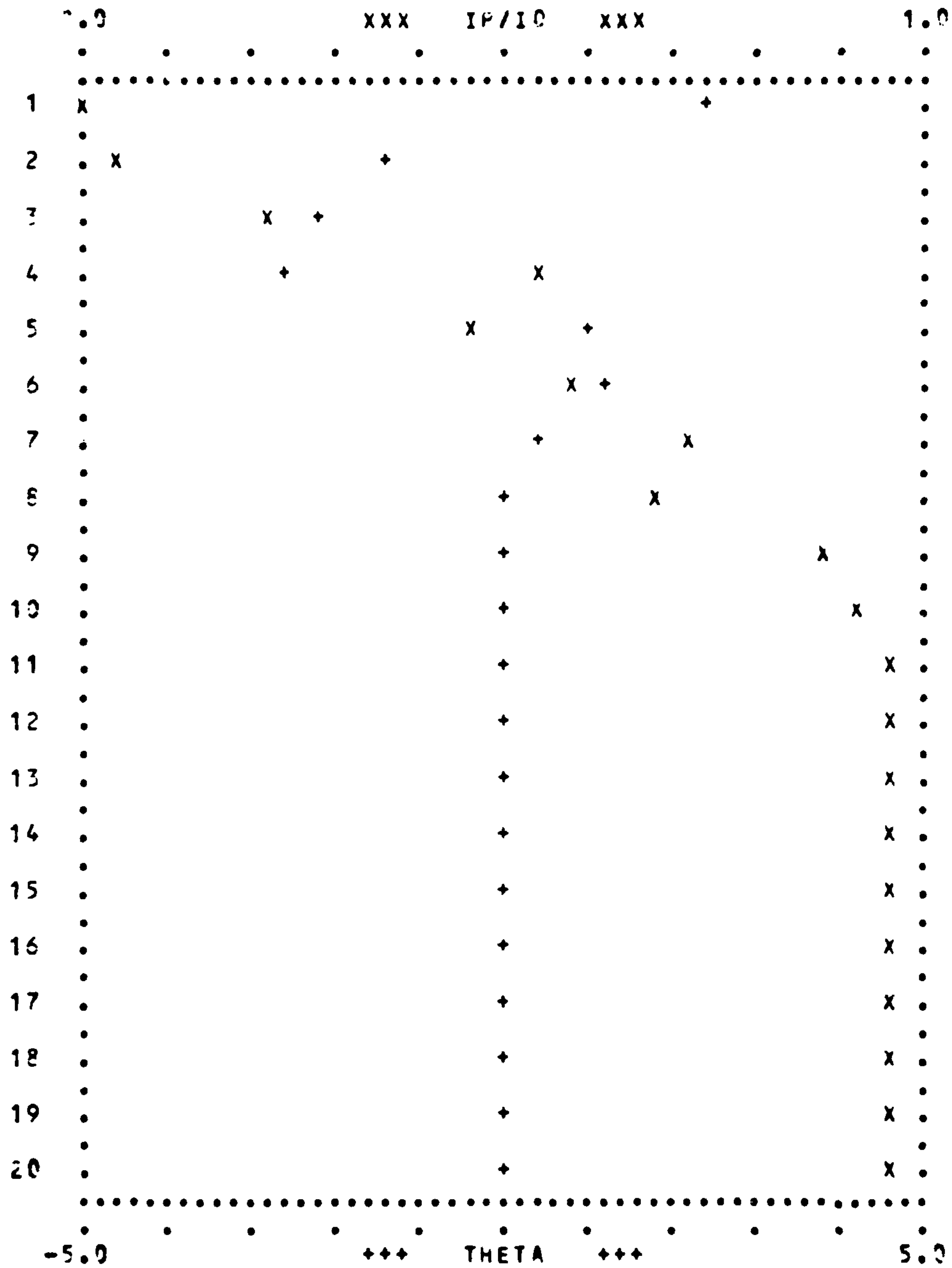

MICROCOPY RESOLUTION TEST CHART
NATIONAL [illegible]



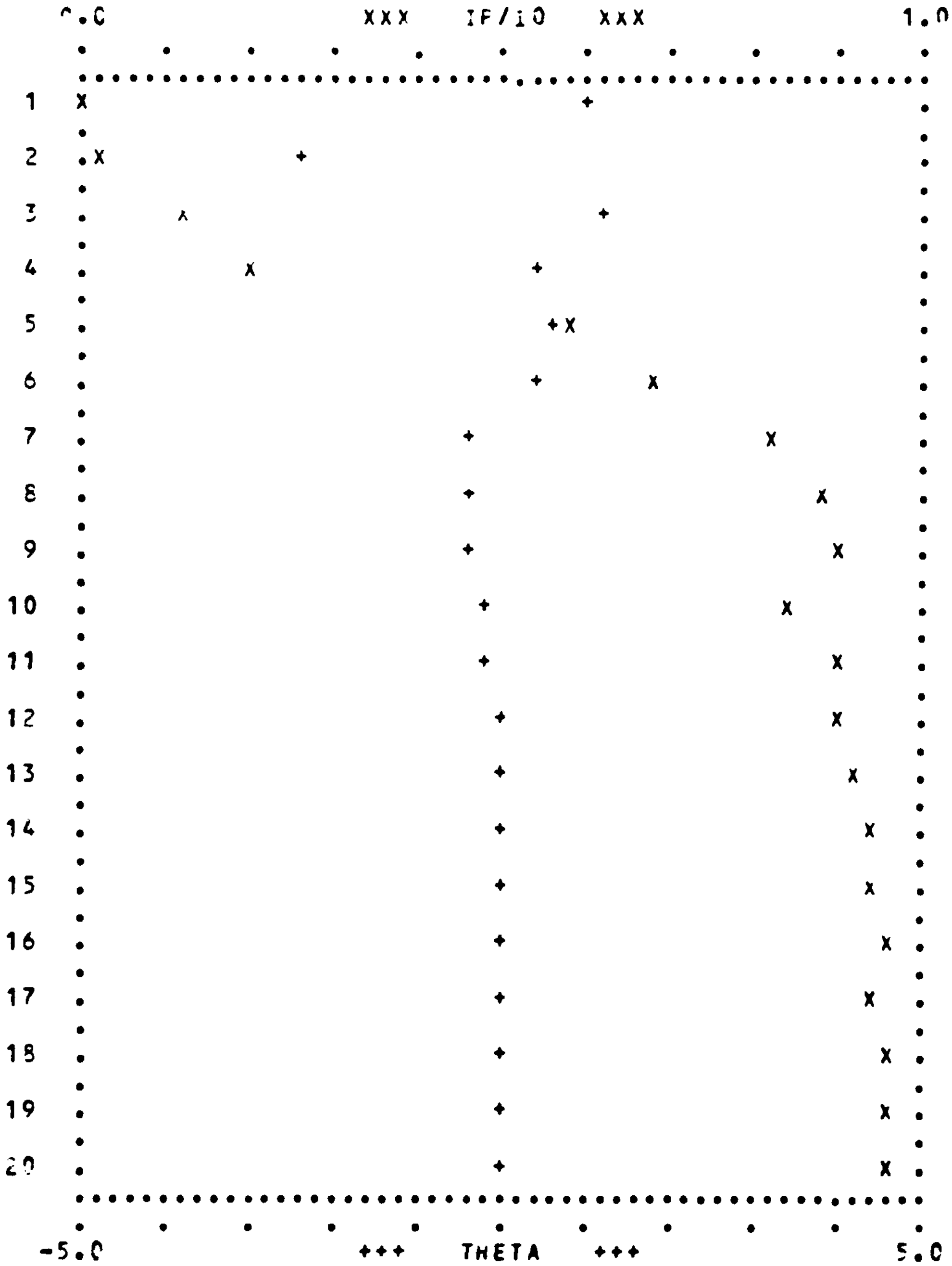
RUN 636. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 76.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



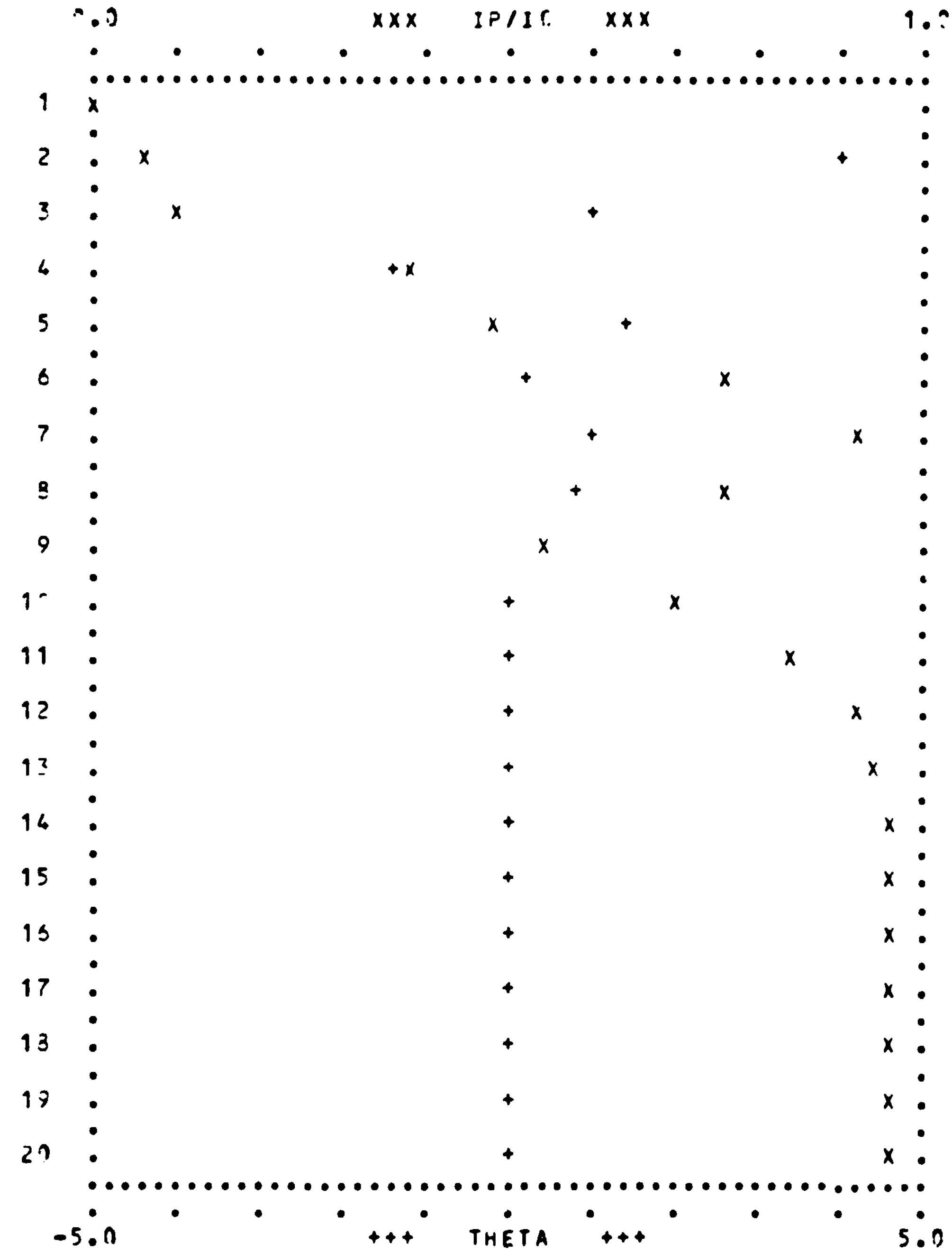

RUN 637. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



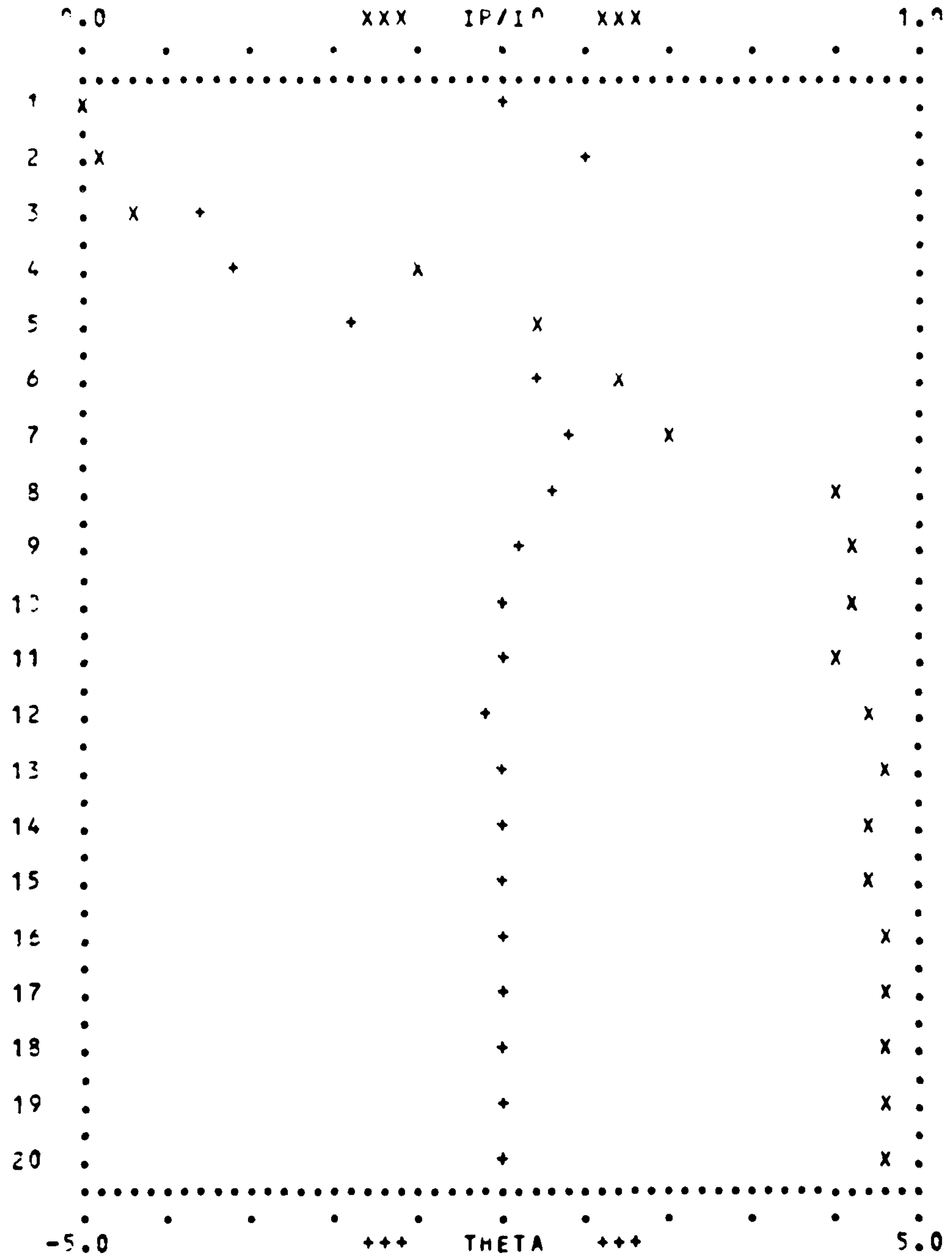

RUN 638. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



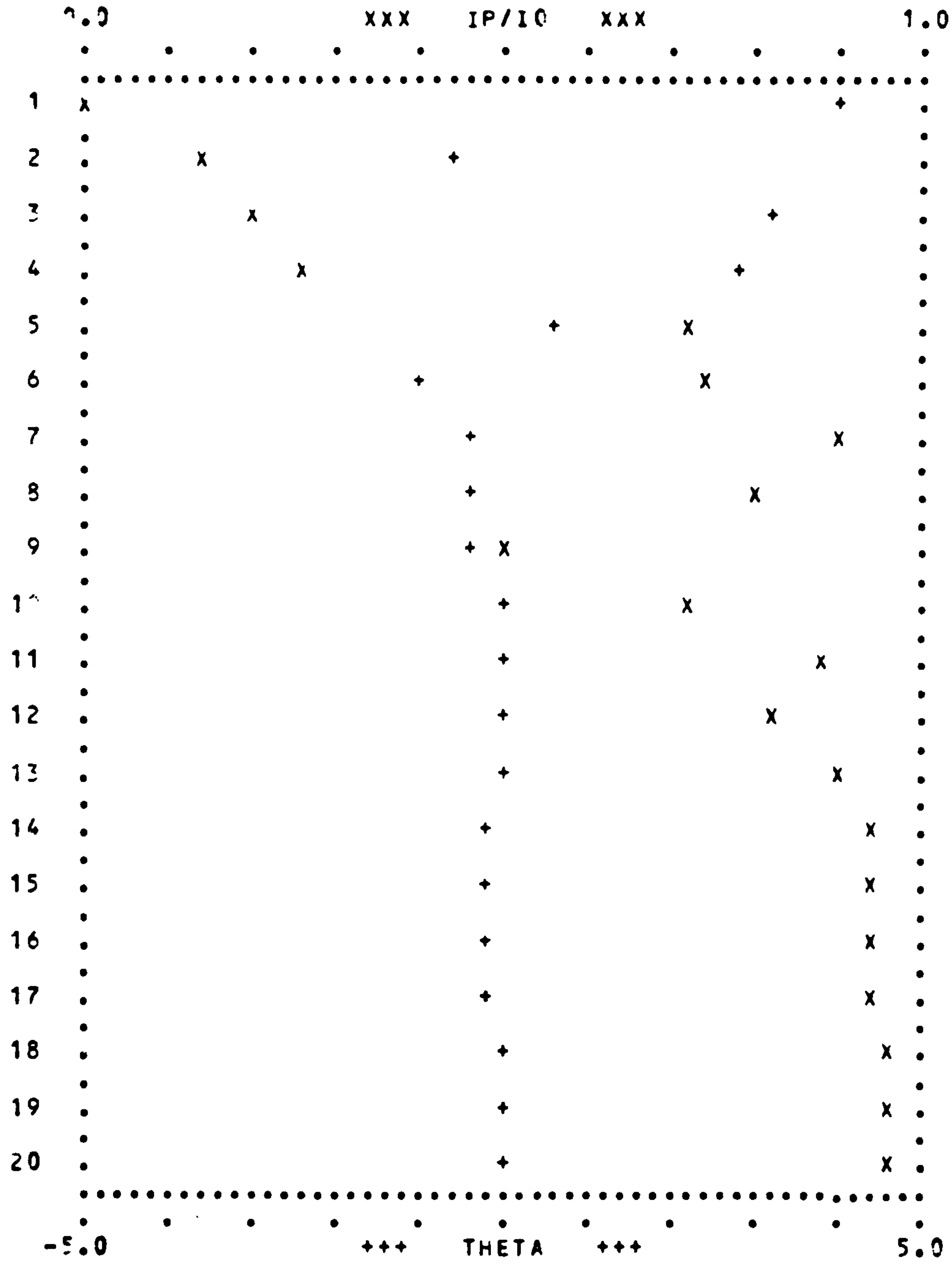

RUN 639. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



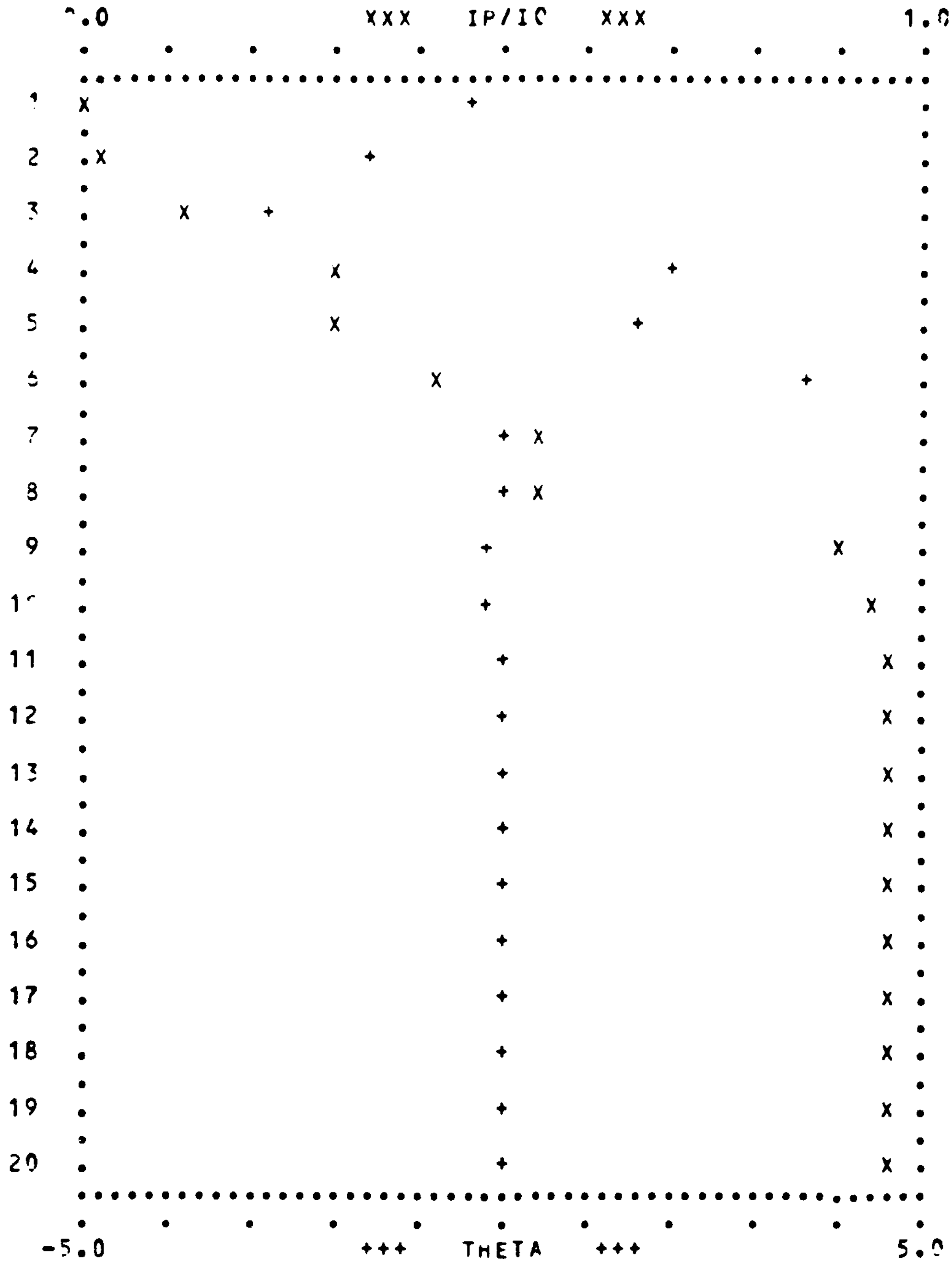

RUN 640. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



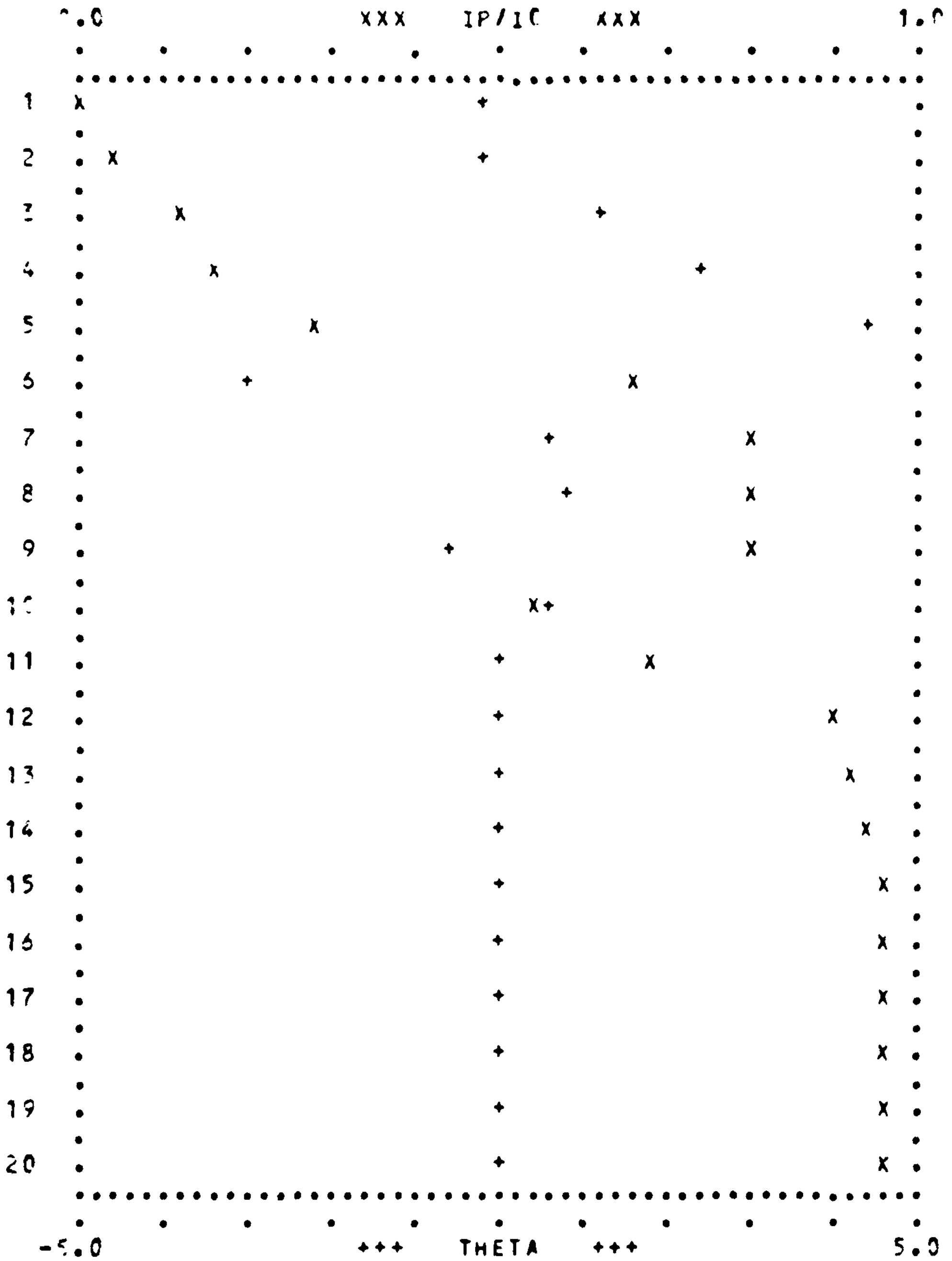

RUN 641. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



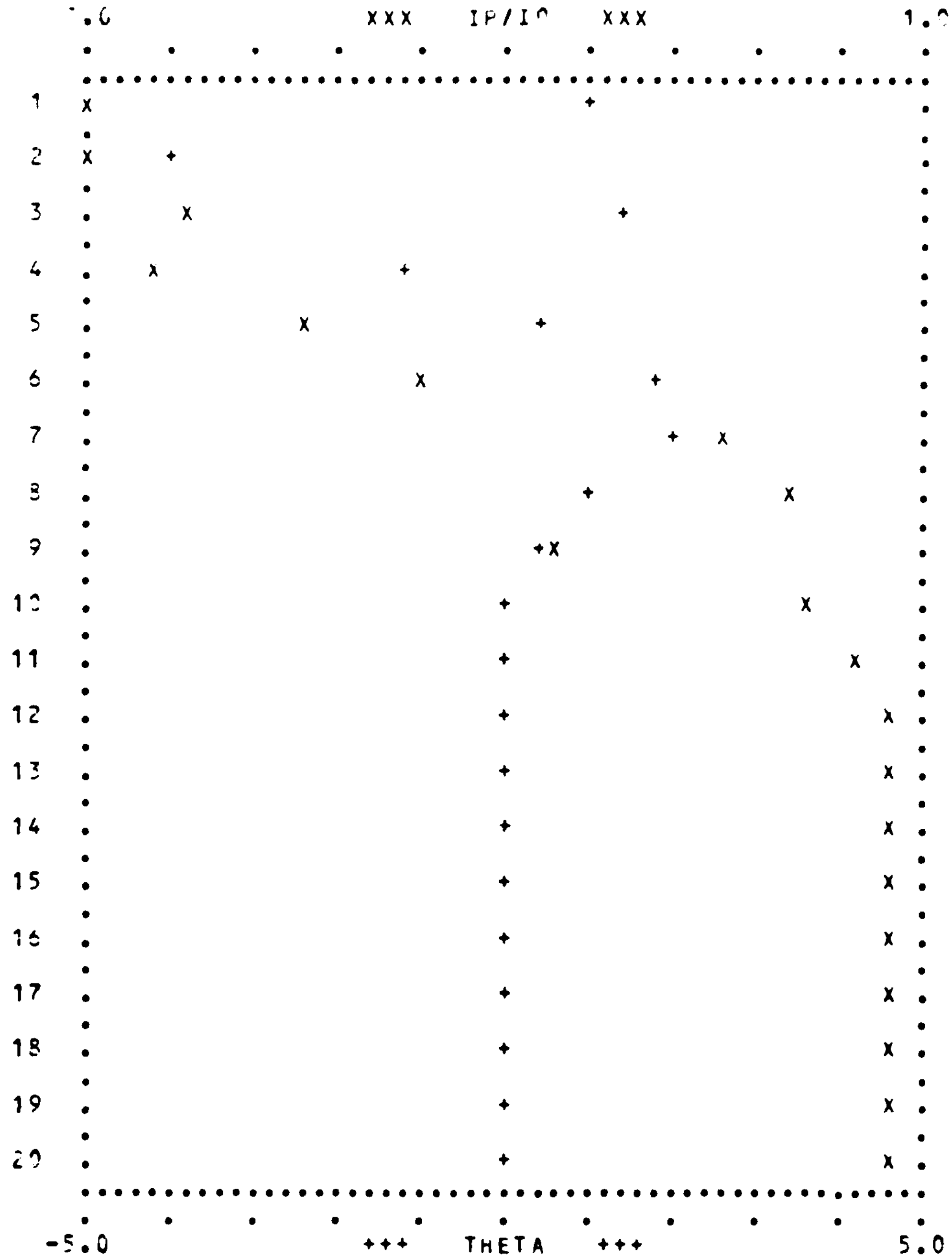

RUN 642. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 153.60000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



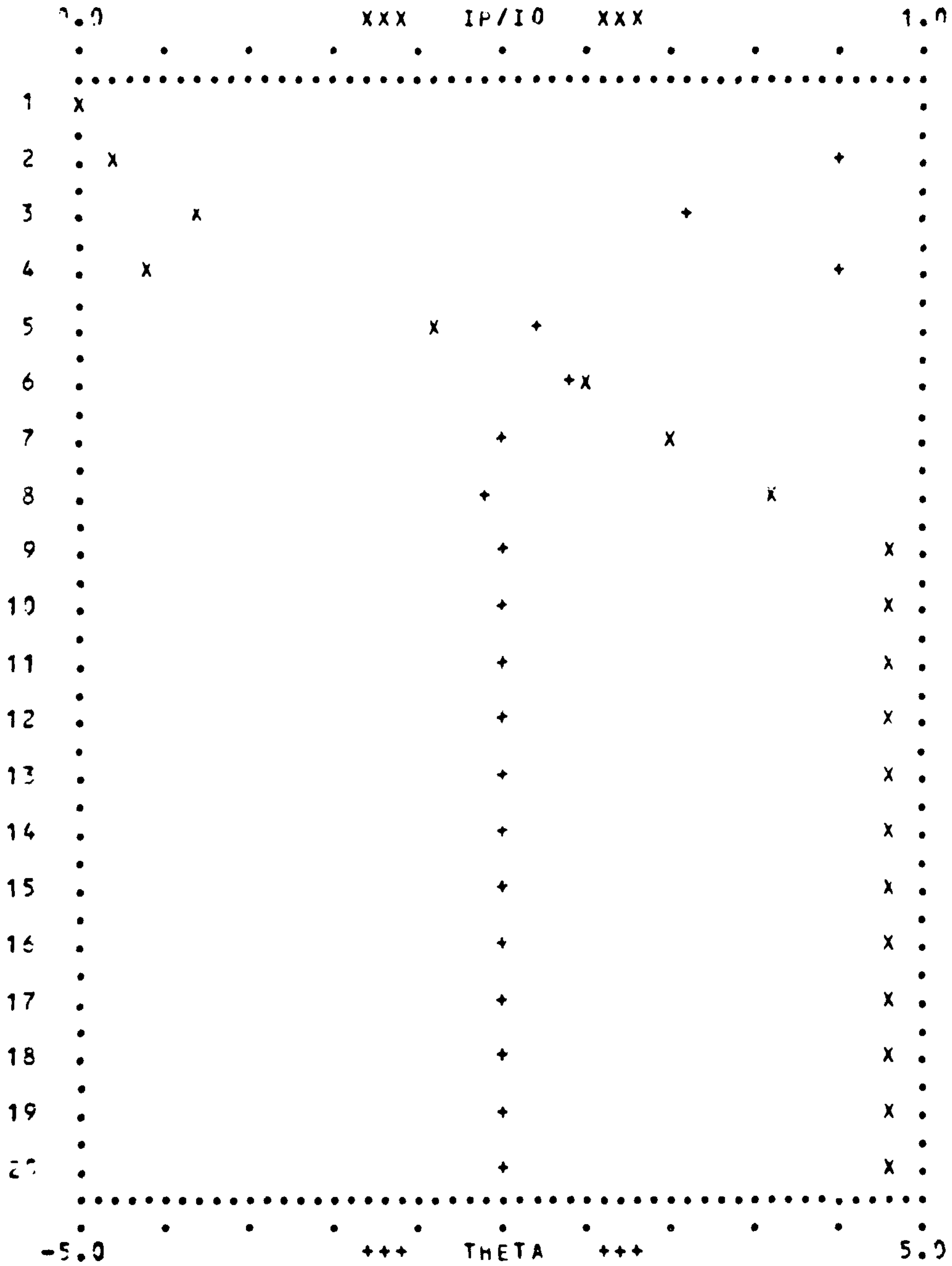

RUN 643. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



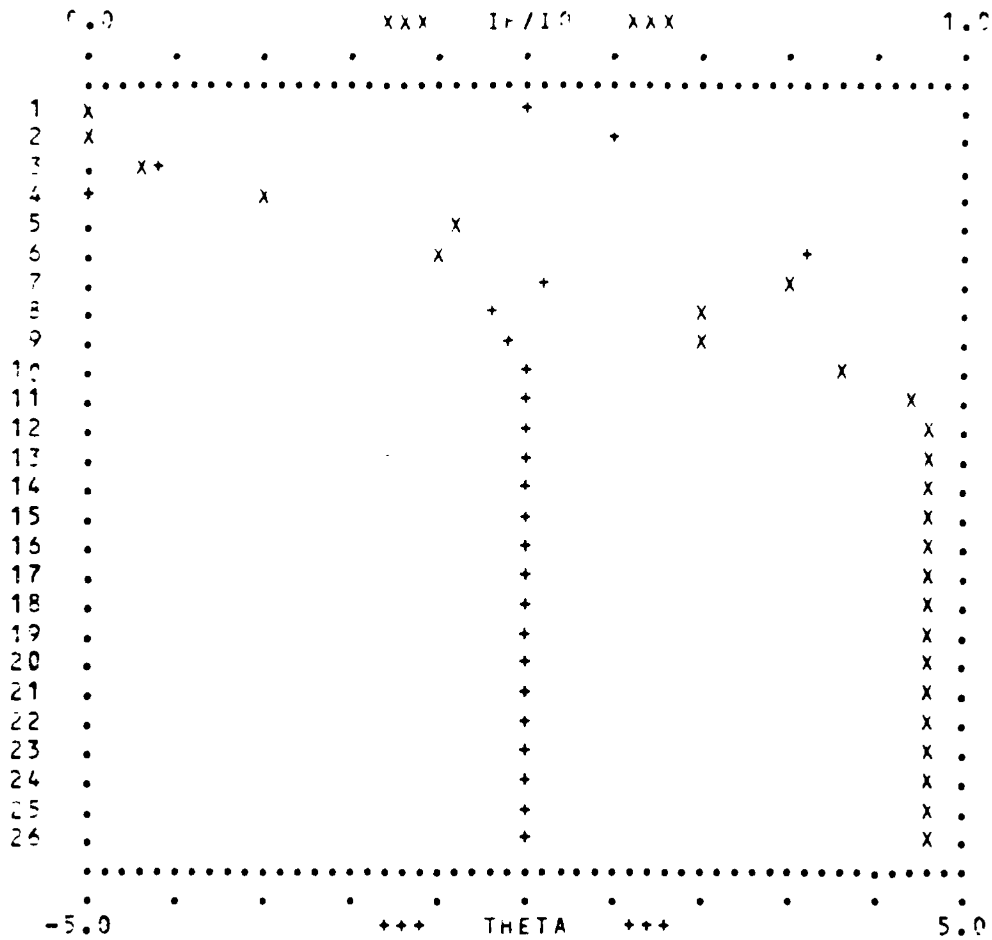

RUN 644. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



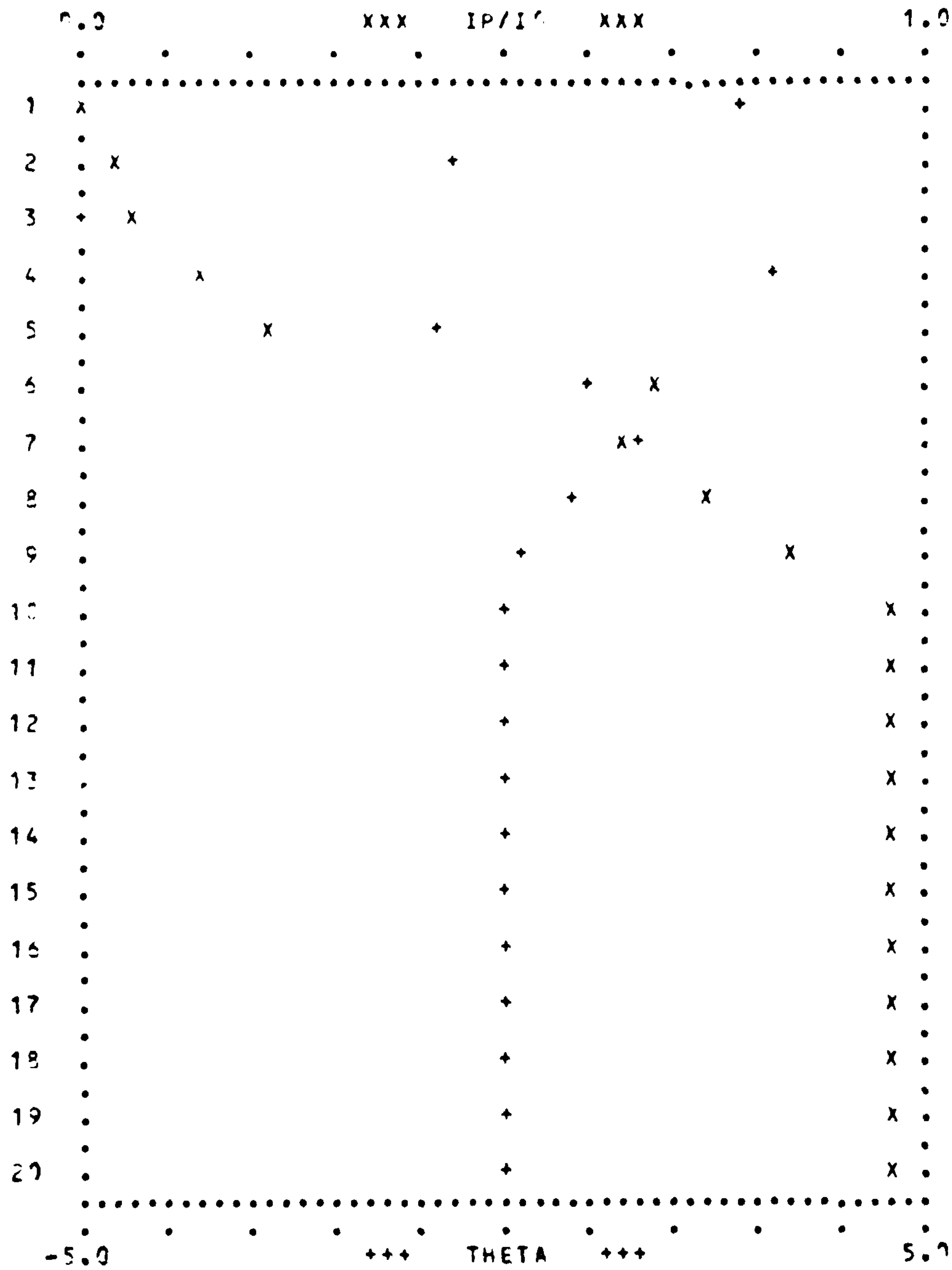

RUN 645. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



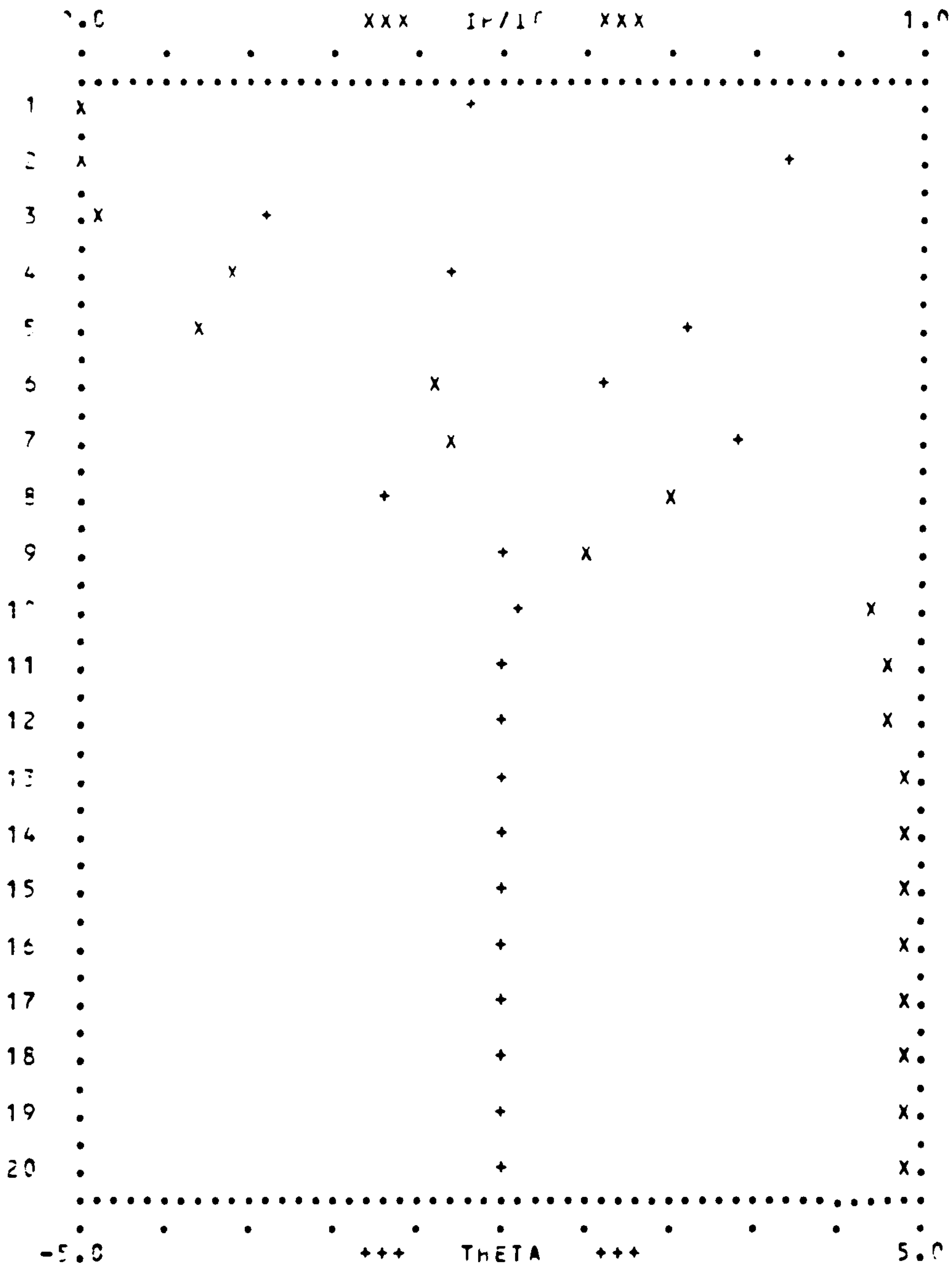

RUN 646. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



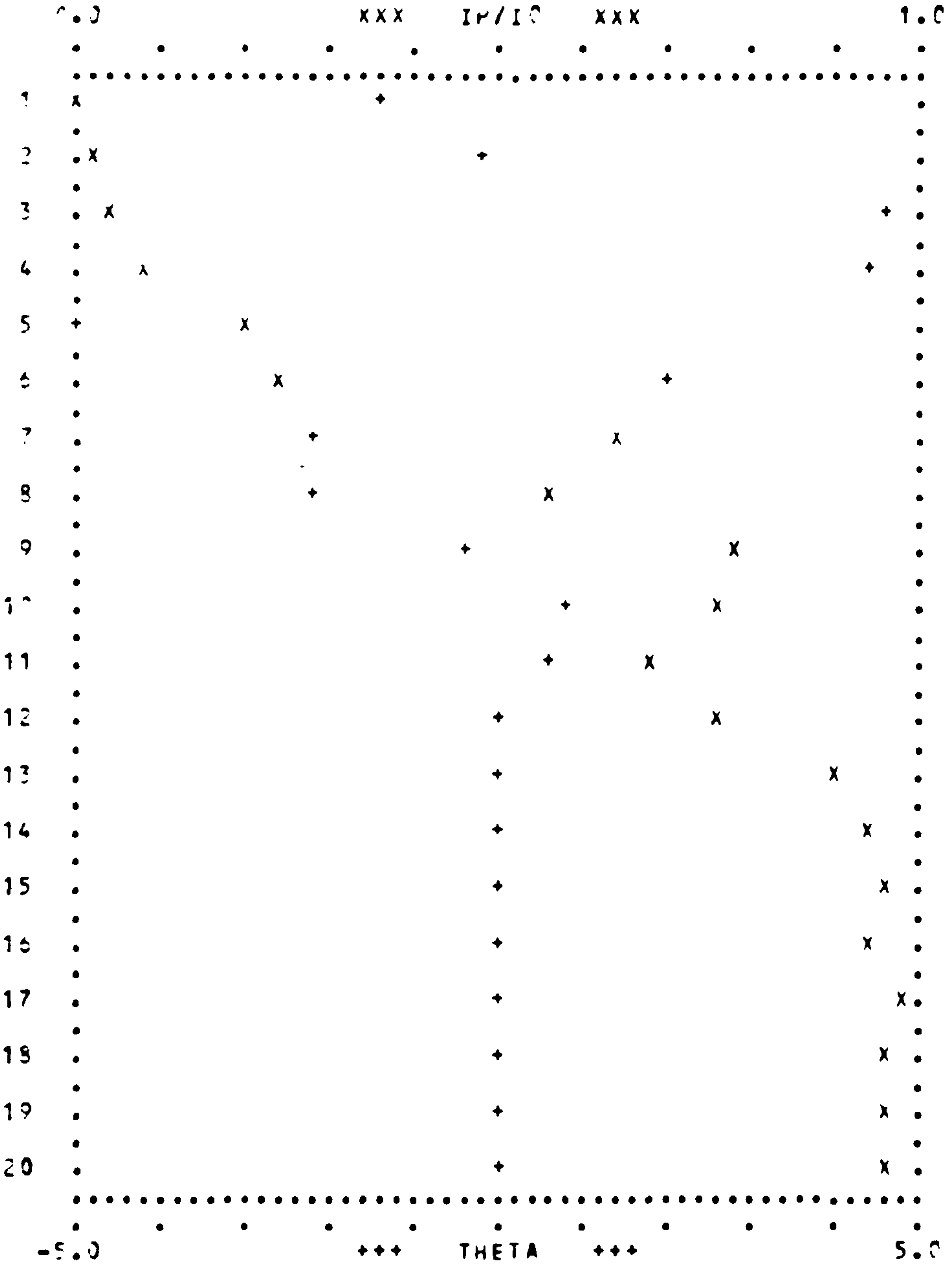

RUN 647. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



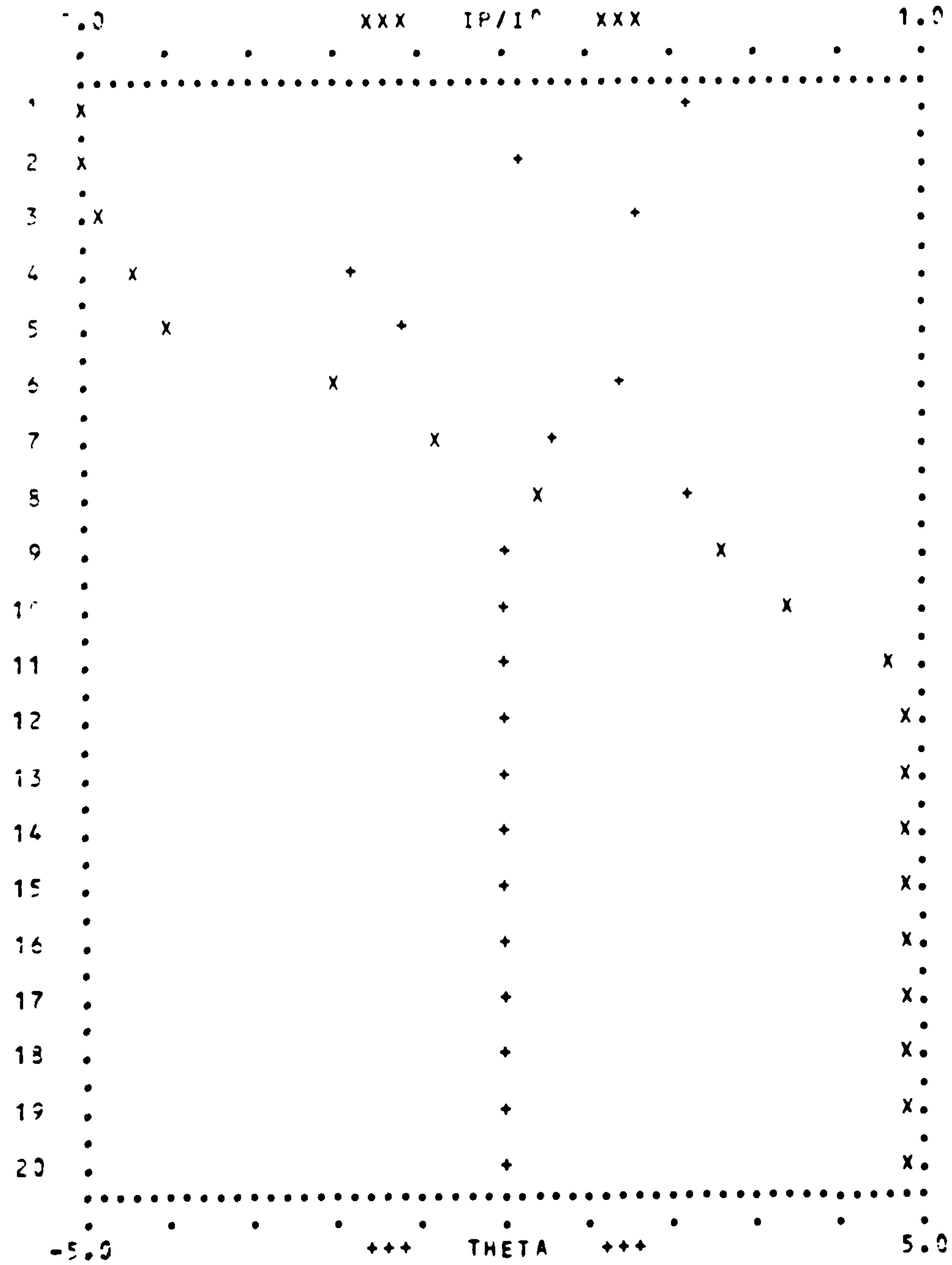
RUN 648. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 307.20000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



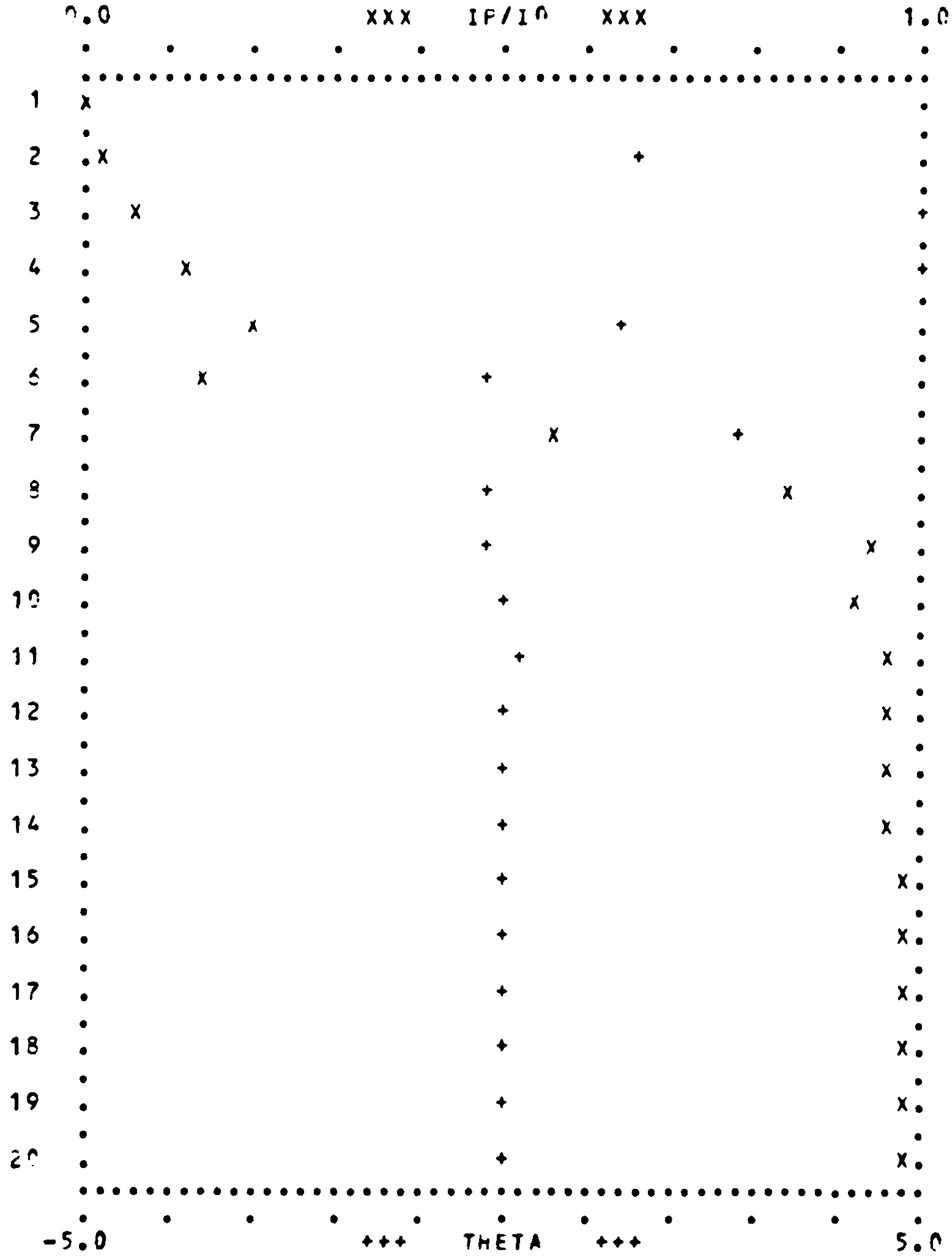
RUN 649. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



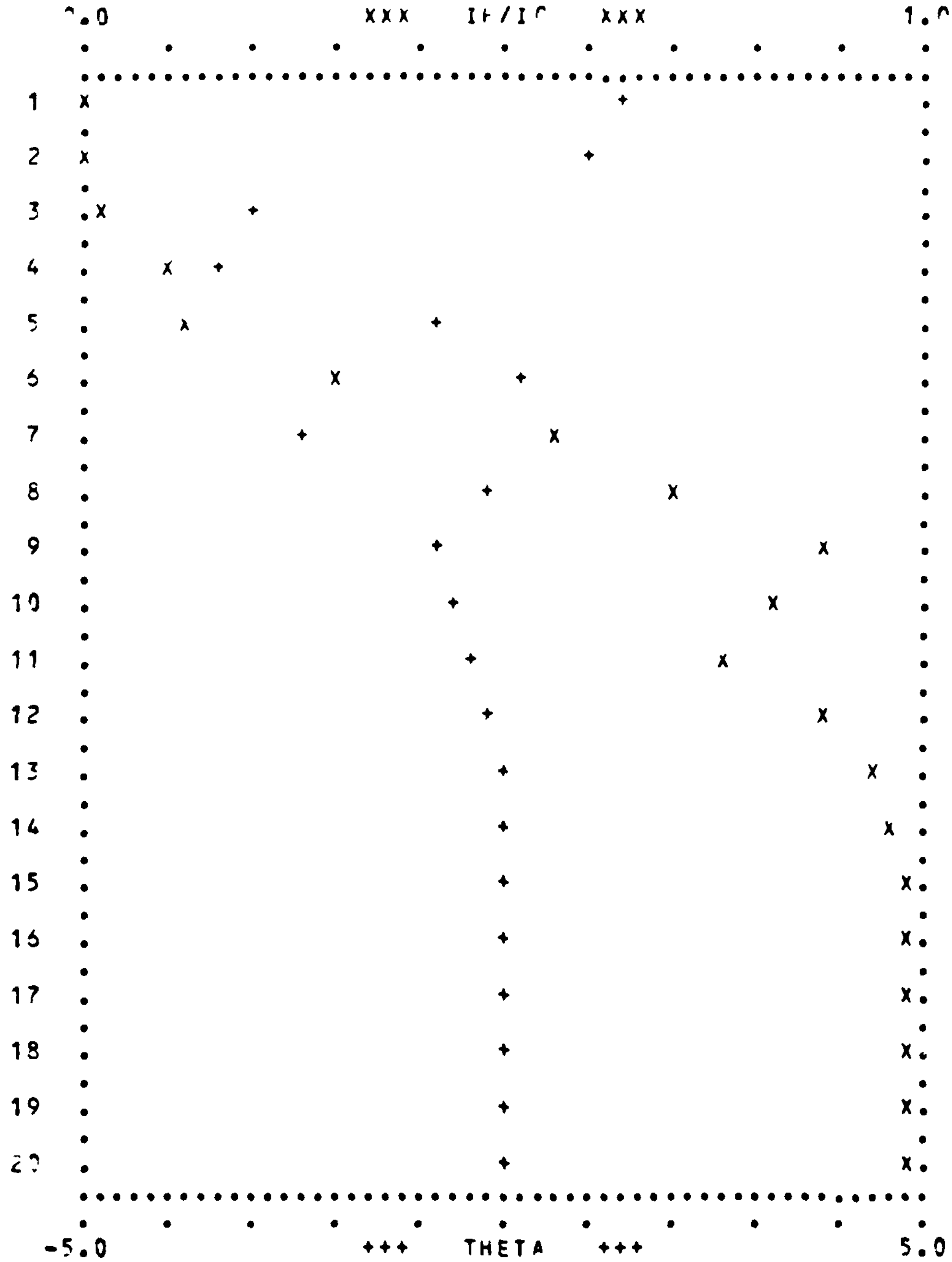

RUN 650. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



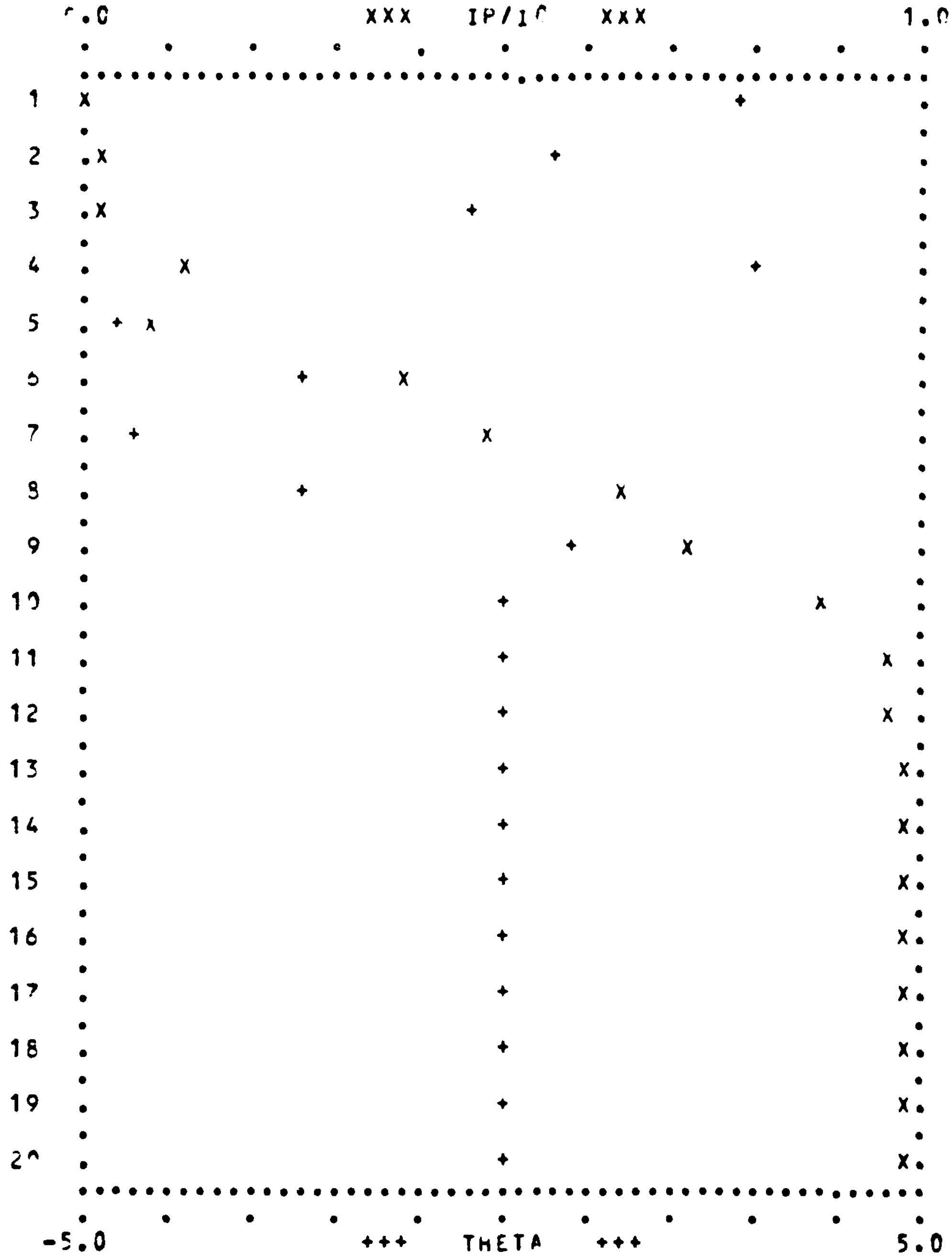
RUN 651. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IC, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



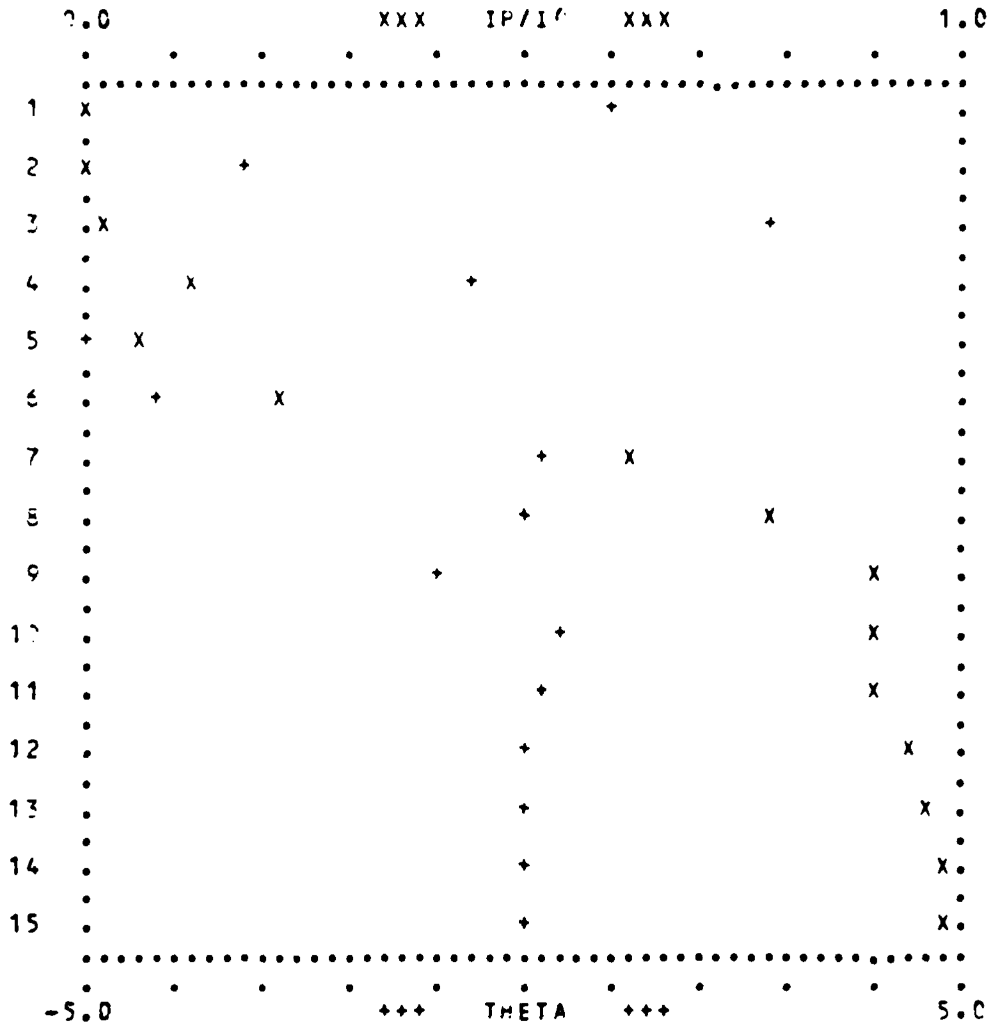

RUN 652. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



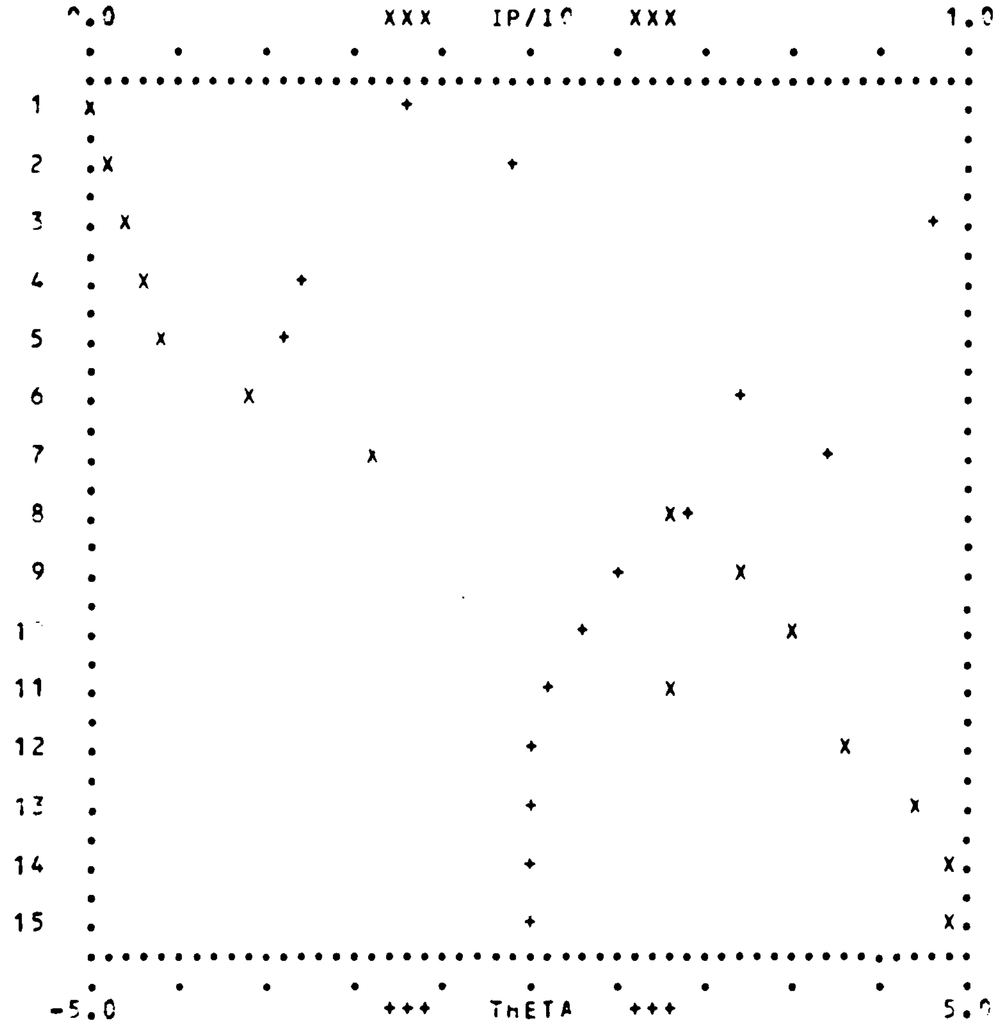

RUN 653. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



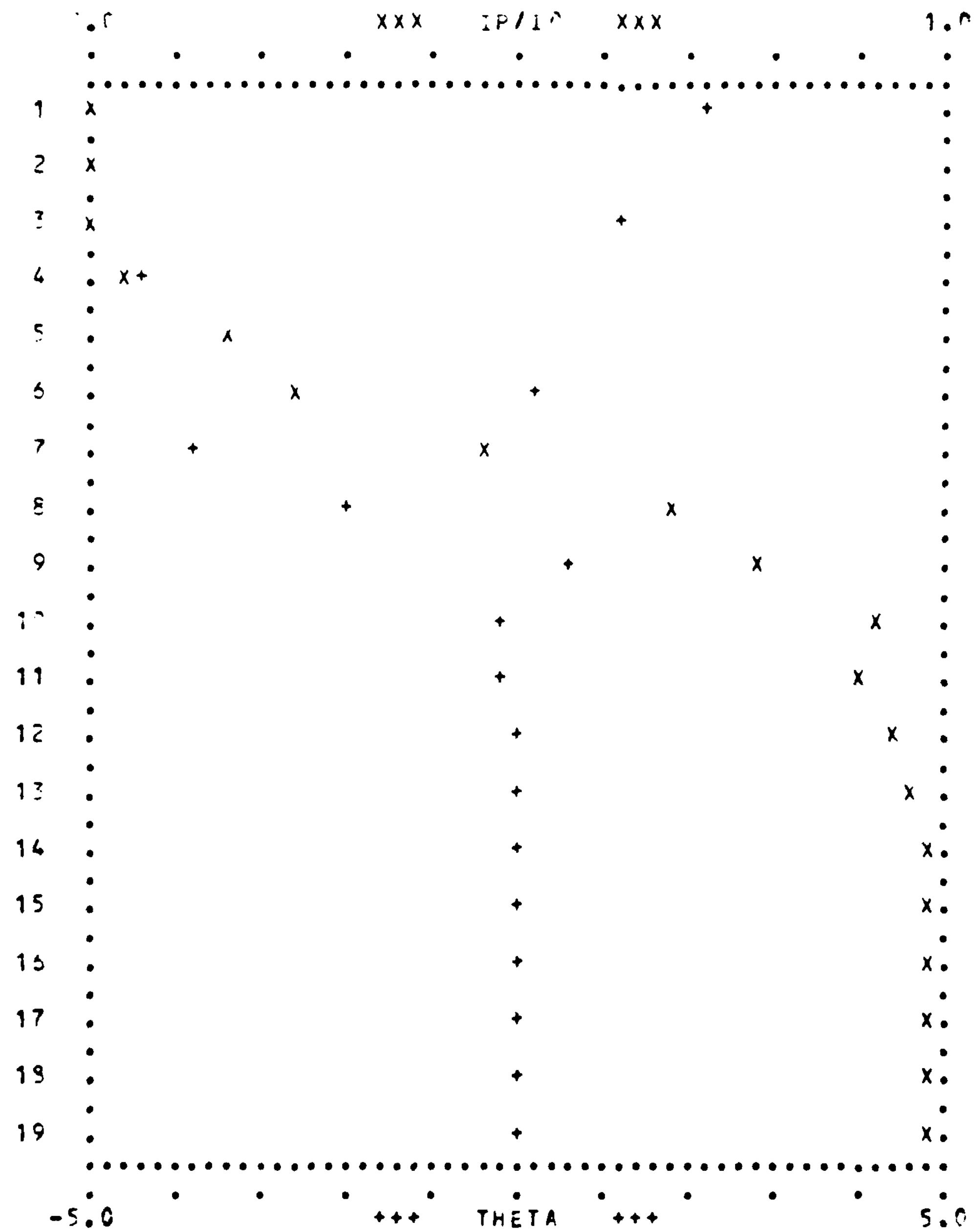

RUN 654. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 614.40000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



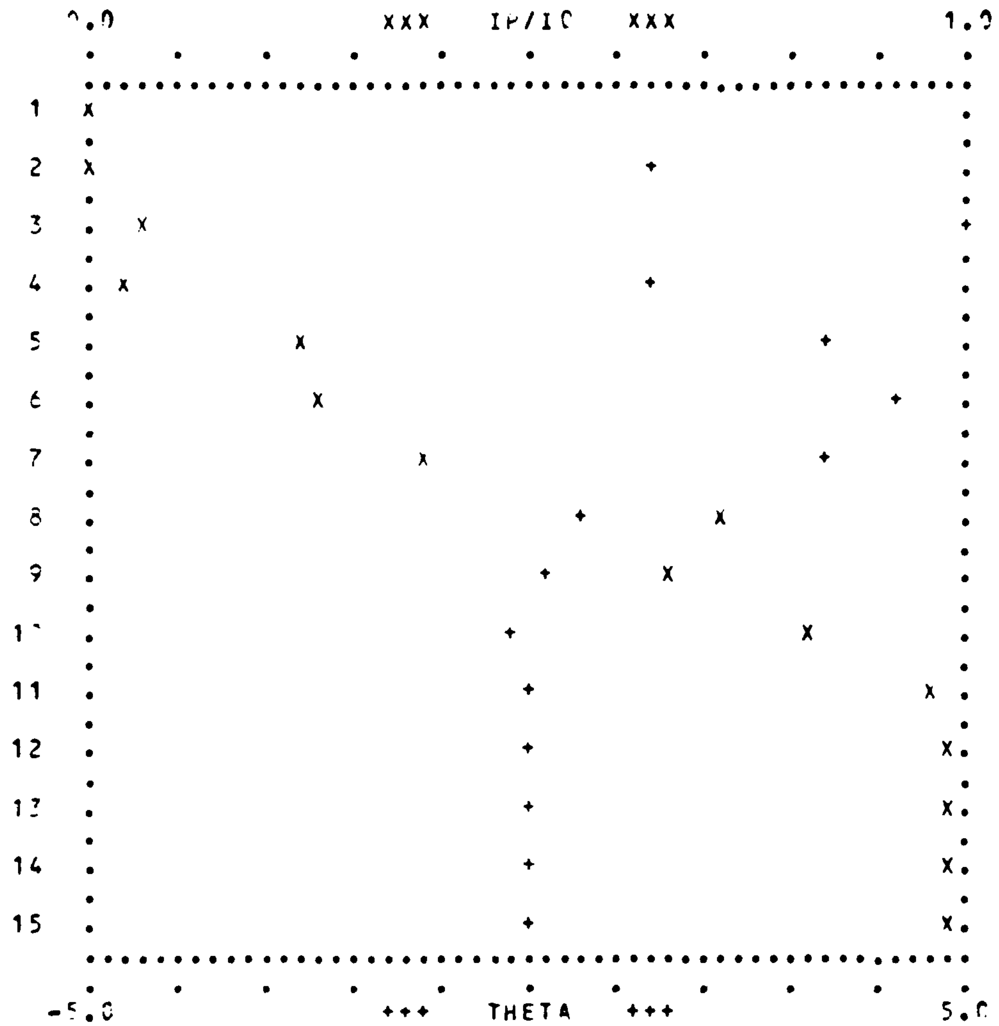

RUN 655. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00000 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



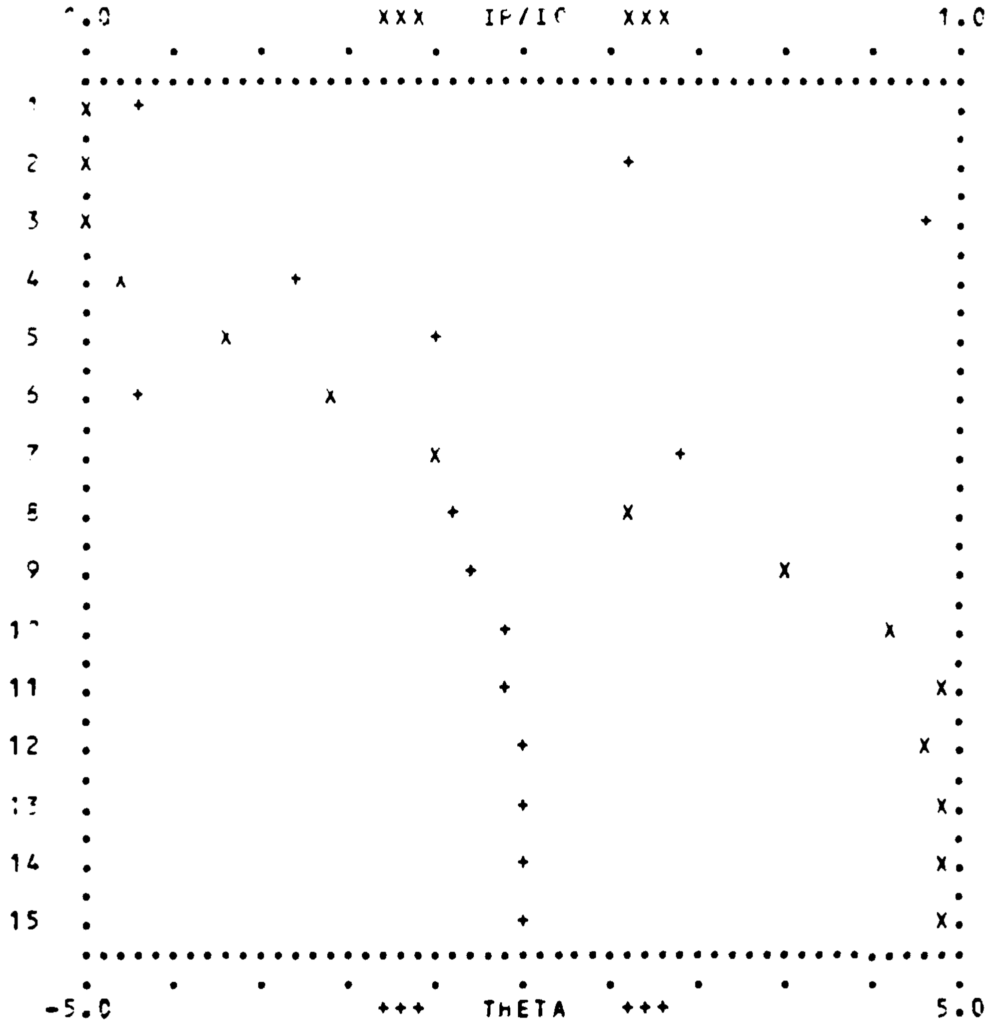

RUN 656. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



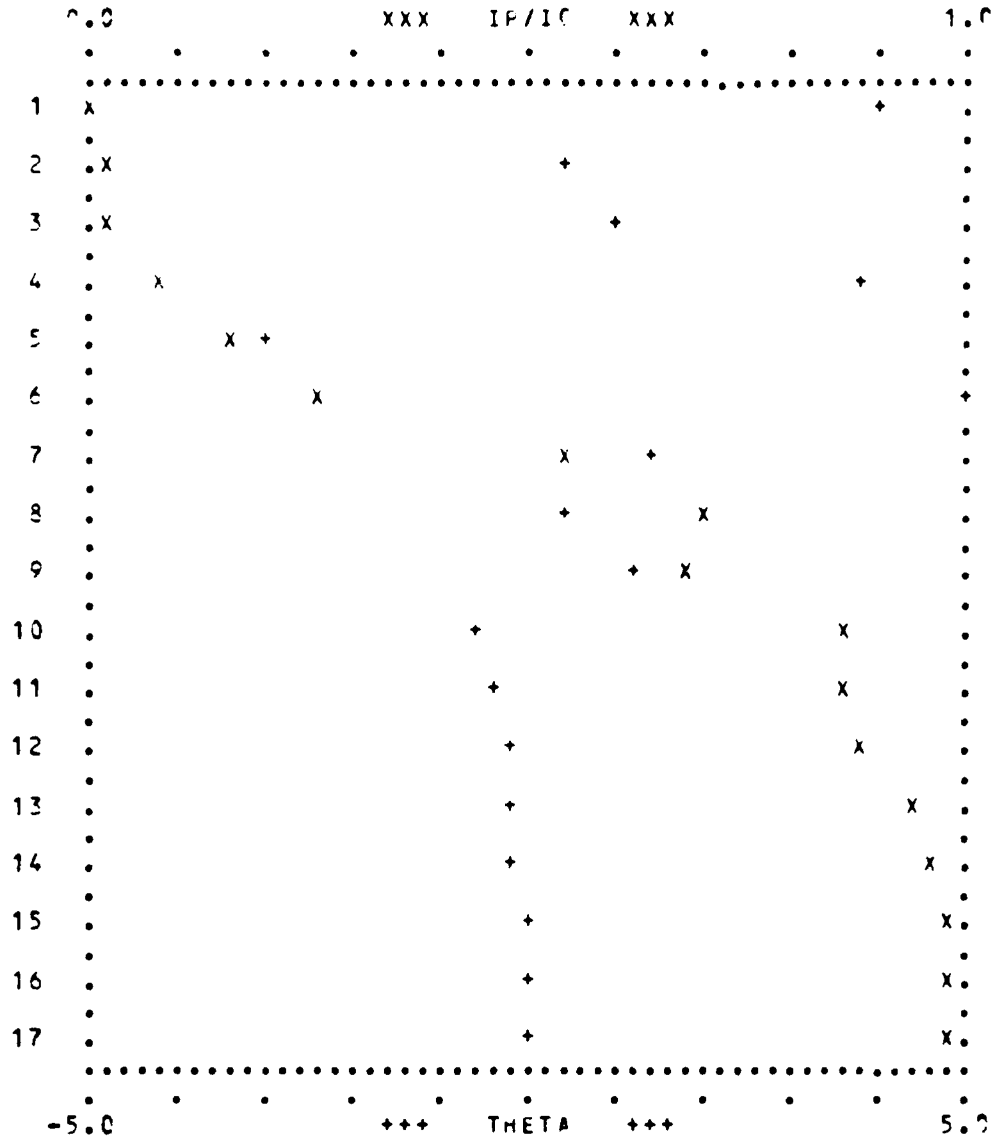

RUN 657. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/I0, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.




RUN 658. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.

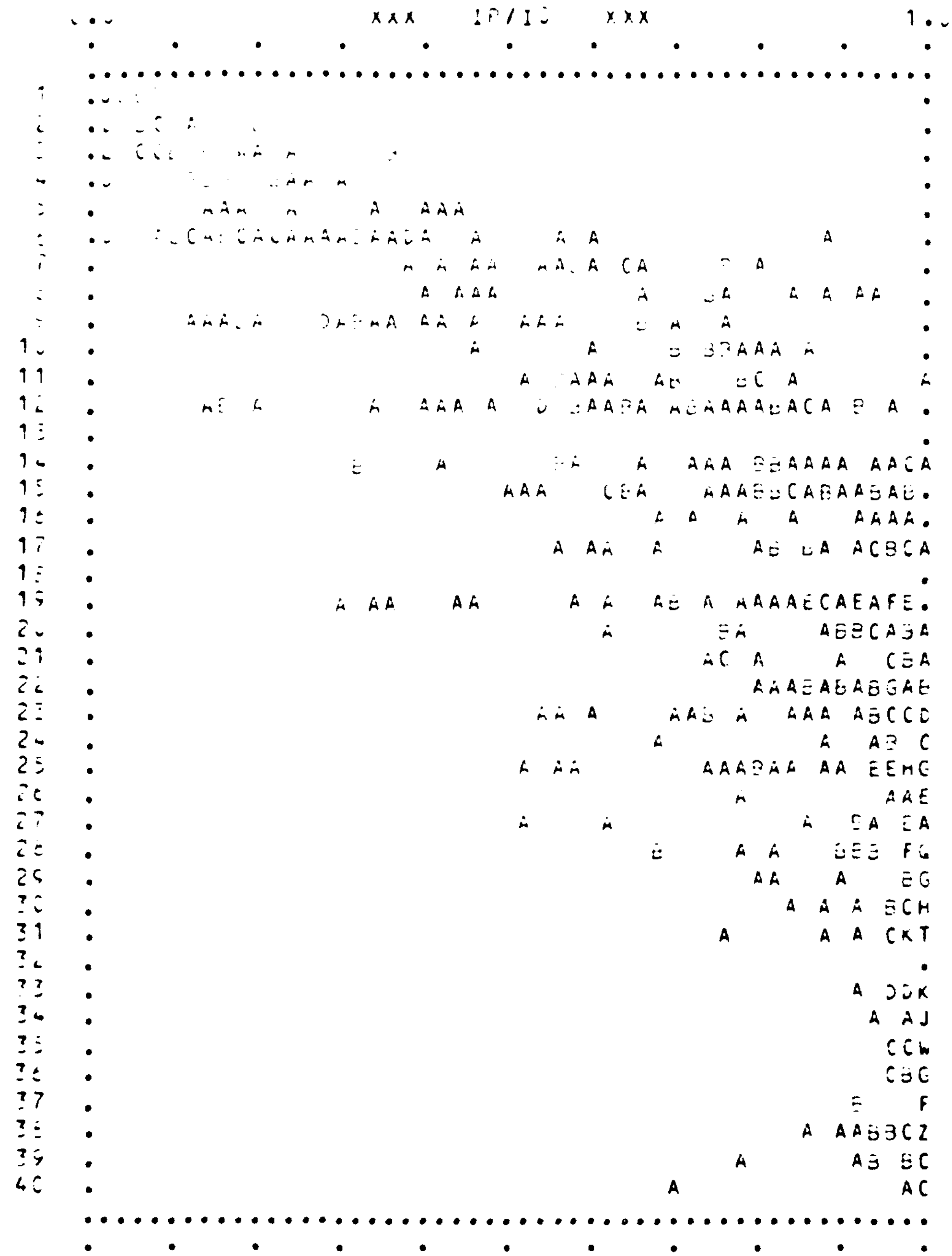



RUN 659. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF
CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X.
THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A
DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT
OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION.
TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003
ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.



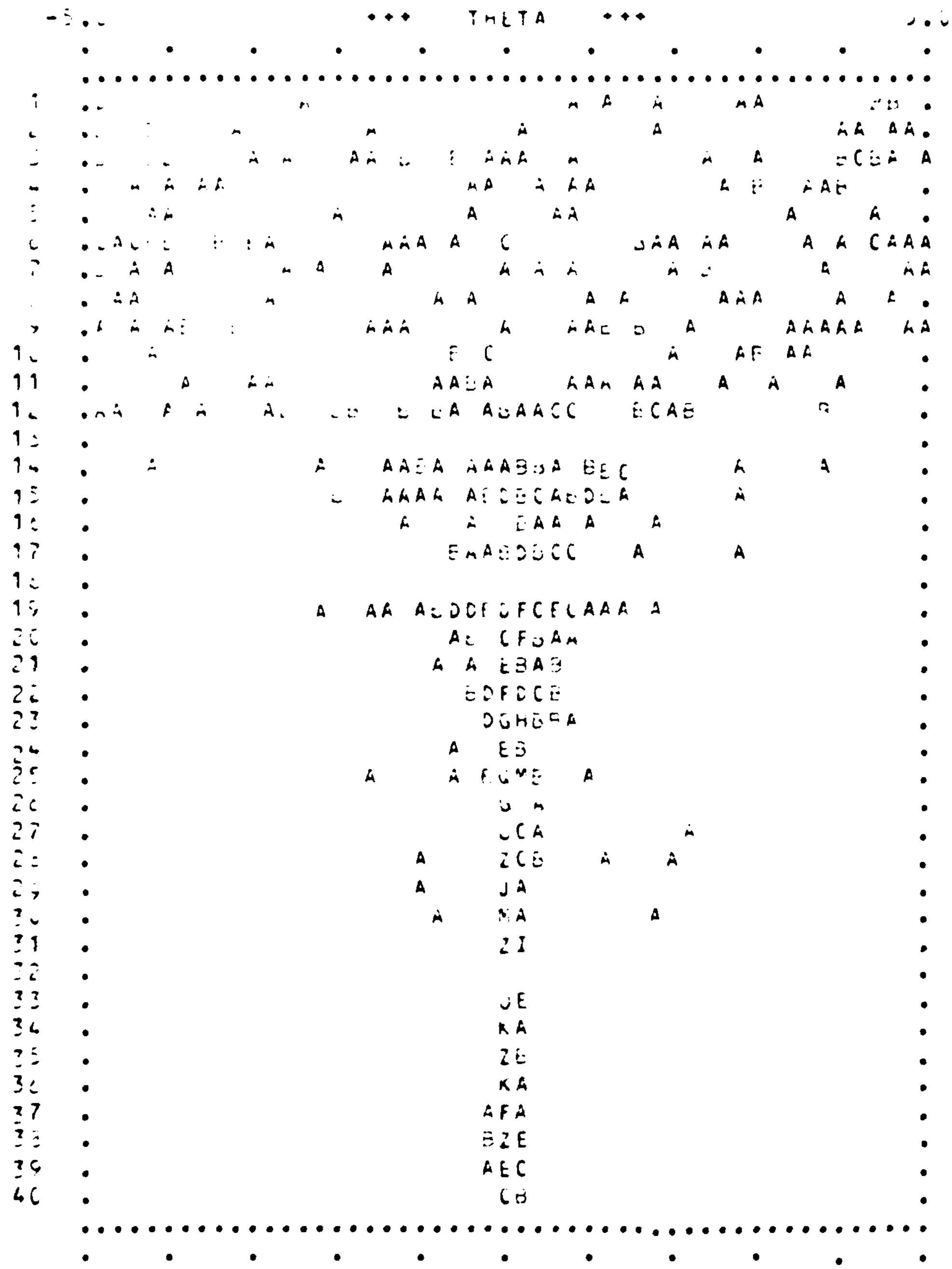

RUN 660. TRANSVERSE MODE FORMATION. RELATIVE VALUES OF CENTRAL FAR-FIELD INTENSITY IP/IO, ARE INDICATED BY X. THE ANGLE THETA MEASURES THE DEVIATION (IN UNITS OF A DIFFRACTION ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD DIRECTION. TUBE FRESNEL NUMBER= 1228.80000;MAGNIFICATION=2.00003 ALIGNMENT EPSL= .00000;NO OF MESH POINTS ON MIRROR=1024.

## X. COMBINED RESULTS OF SETS OF MODE FORMATION CALCULATIONS WITH SPECIFIED INPUT PARAMETERS

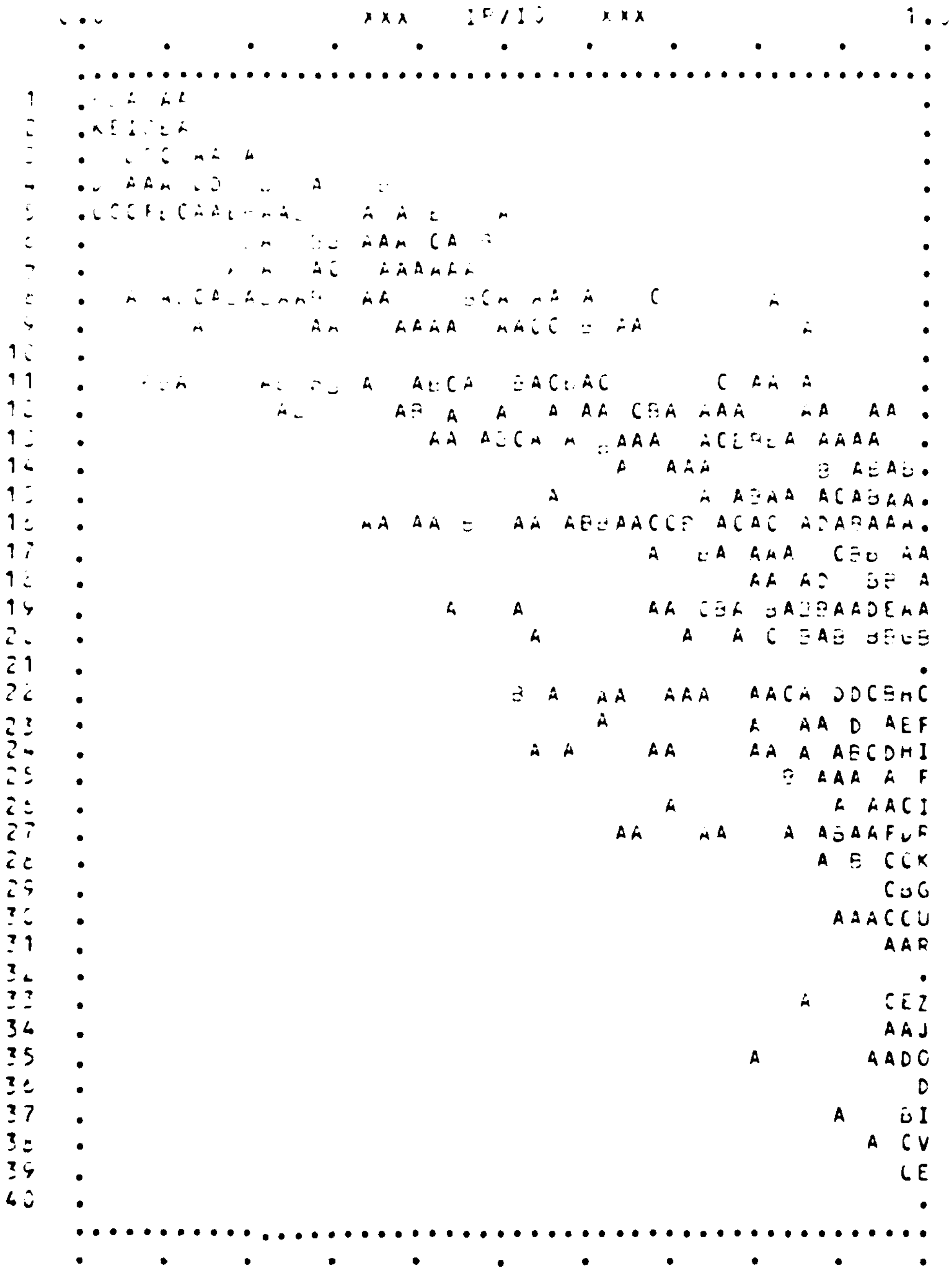


COMBINED RESULTS OF 41 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 00 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XMF2= 70.0: XMAG1=ALL : XNMIR=ALL

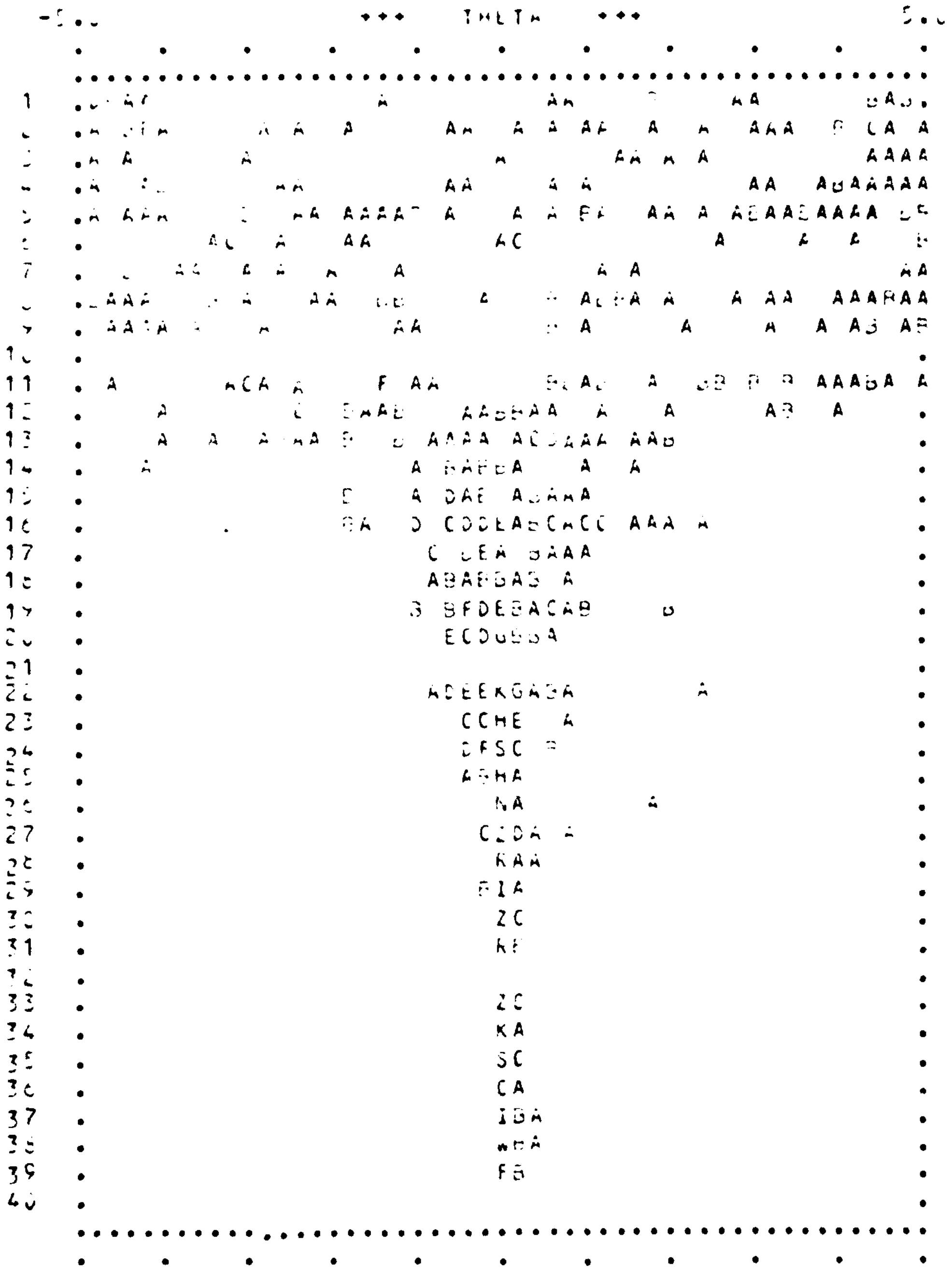



COMBINED RESULTS OF 41 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE
OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT
MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT.
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNF2= 76.8: XMAG1=ALL : XNMIR=ALL



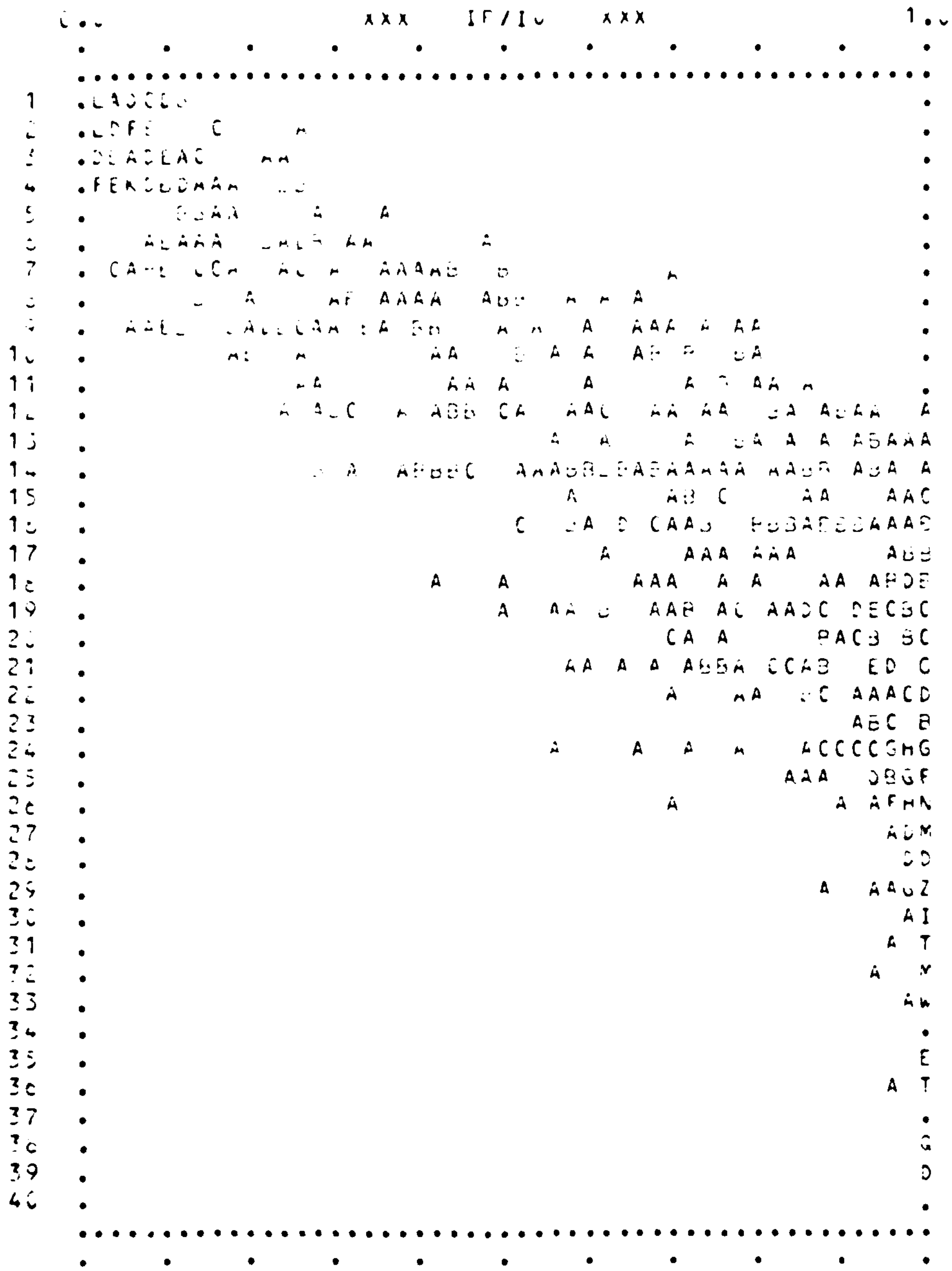
COMBINED RESULTS OF 42 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2= 153.6: XMAGT=ALL : XNMIR=ALL



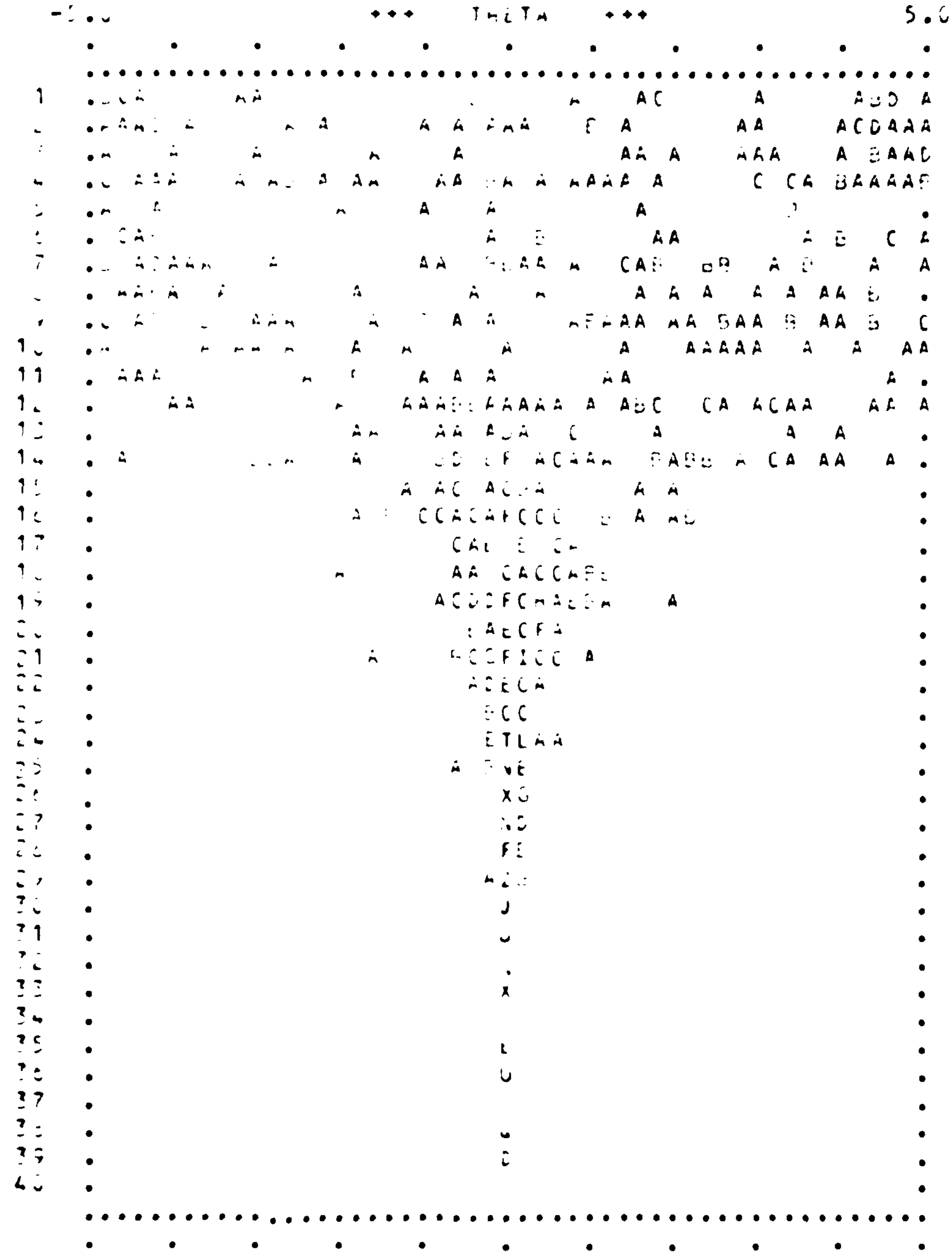

COMBINED RESULTS OF 42 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2= 150.0: XMAG1=ALL : XNMIR=ALL



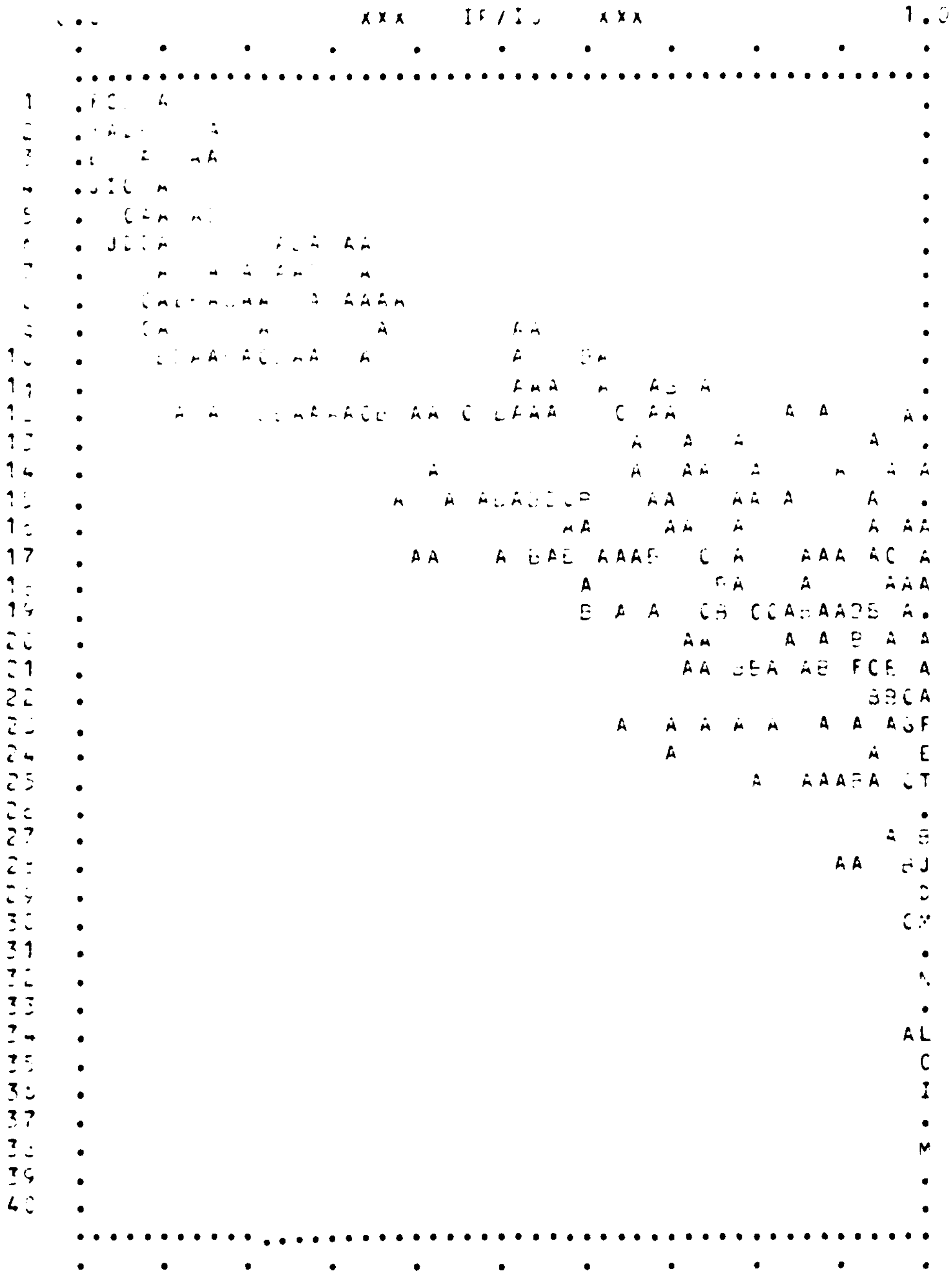
COMBINED RESULTS OF 43 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2= 307.2: XMAG1=ALL : XNMIR=ALL

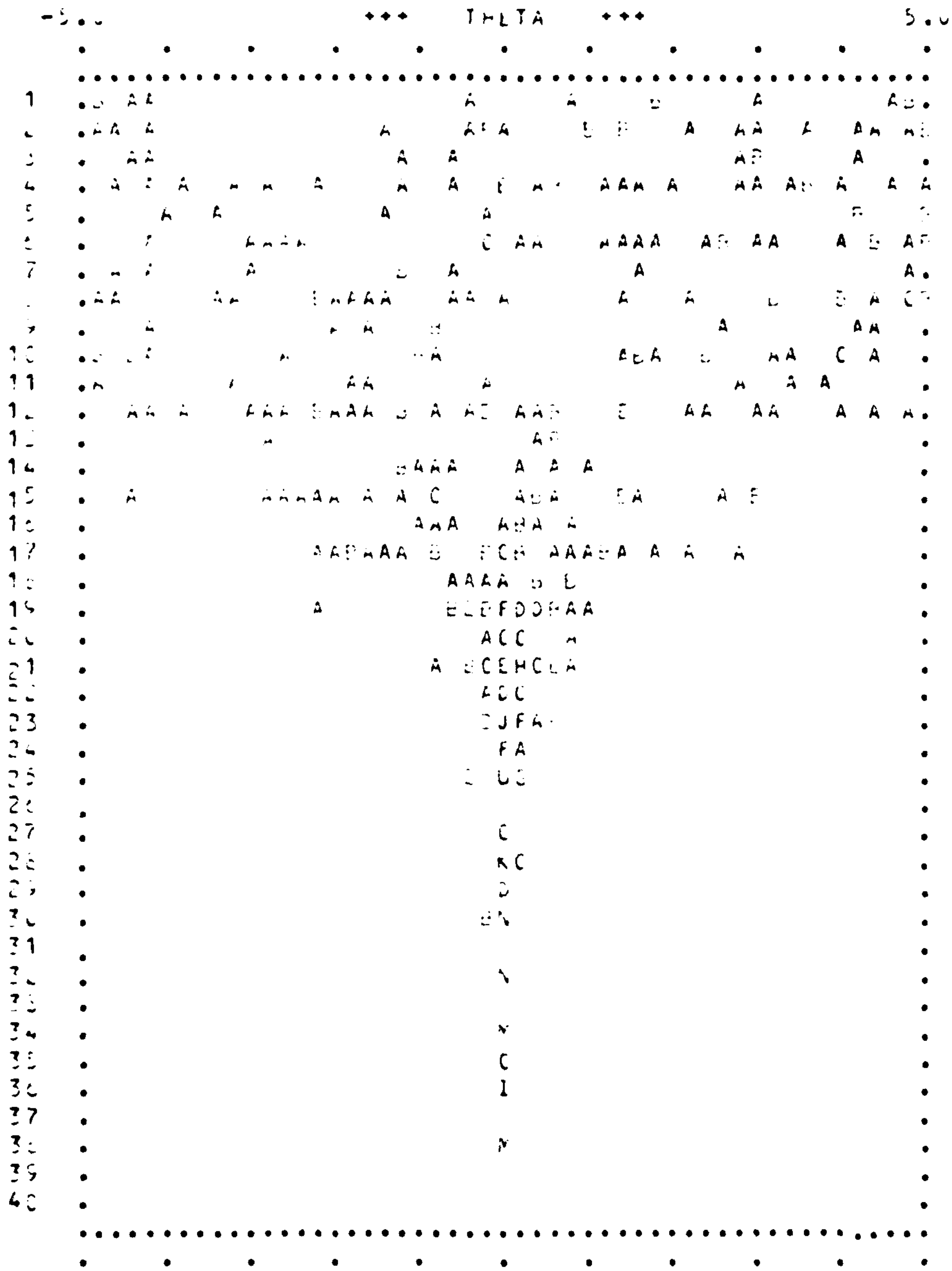



COMBINED RESULTS OF 43 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

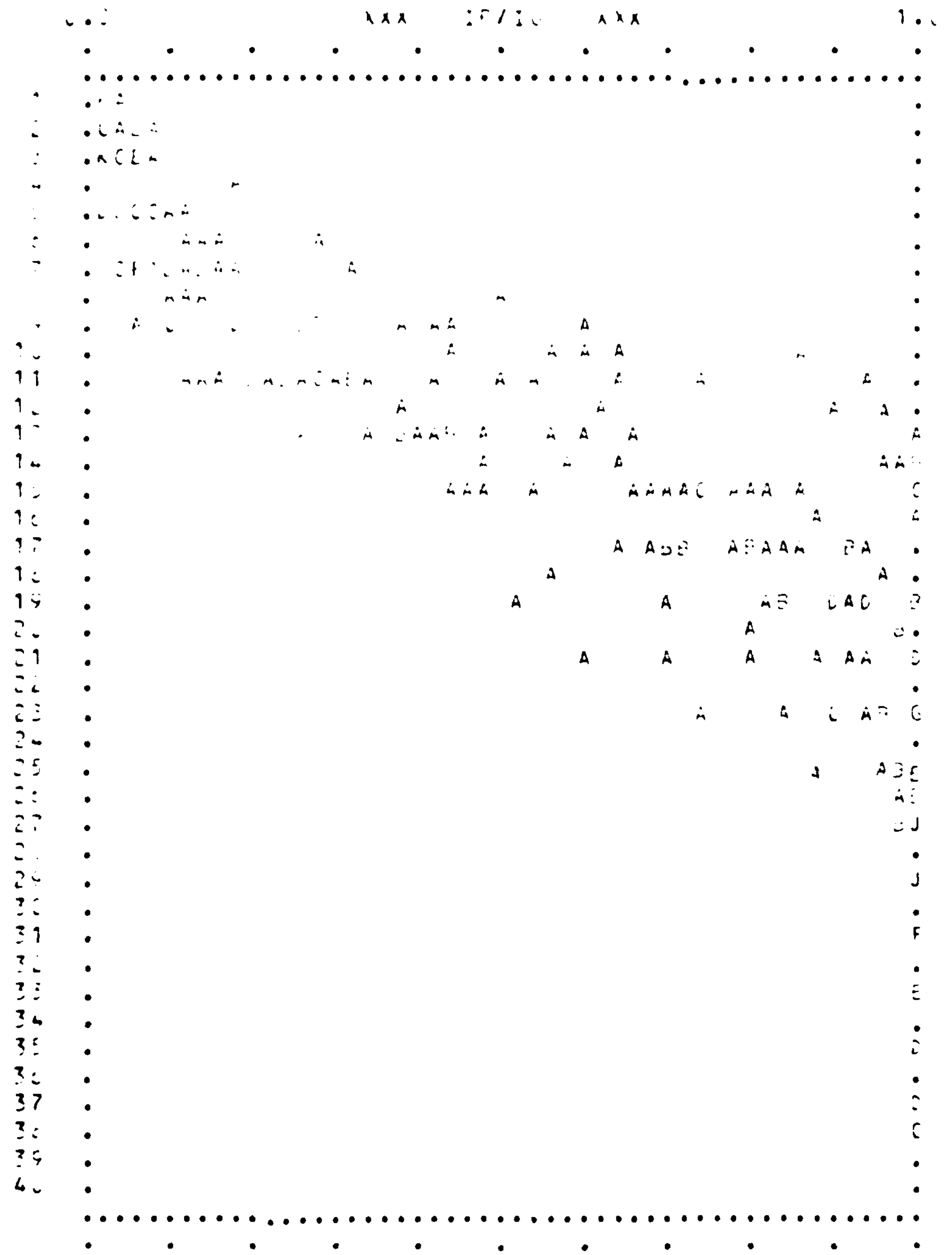
XNF2= 307.0: XMAG1=ALL : XNMIR=ALL



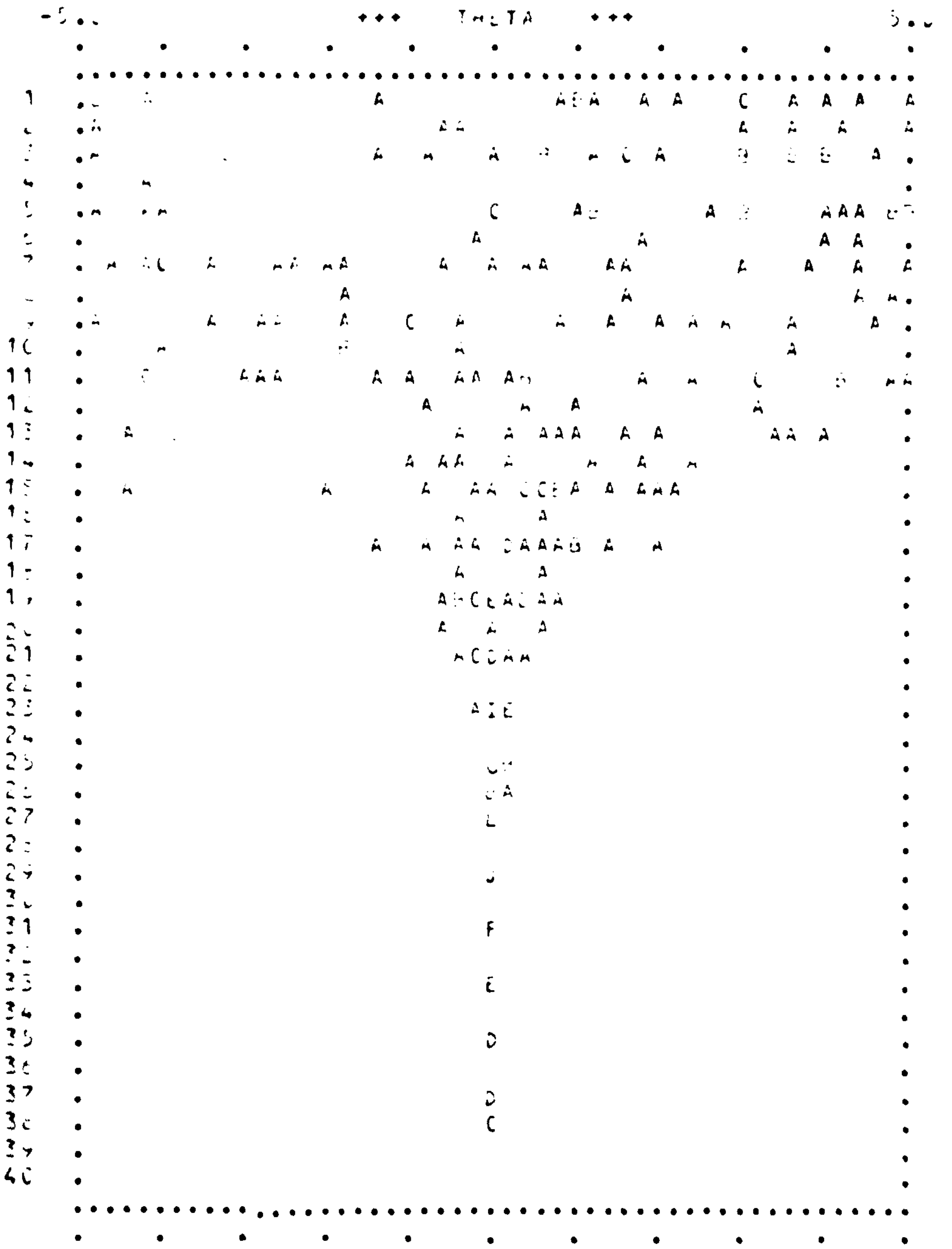
COMBINED RESULTS OF 29 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE
OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT
MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT.
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNFO= =14.4: XMAG1=ALL : XNMIR=ALL



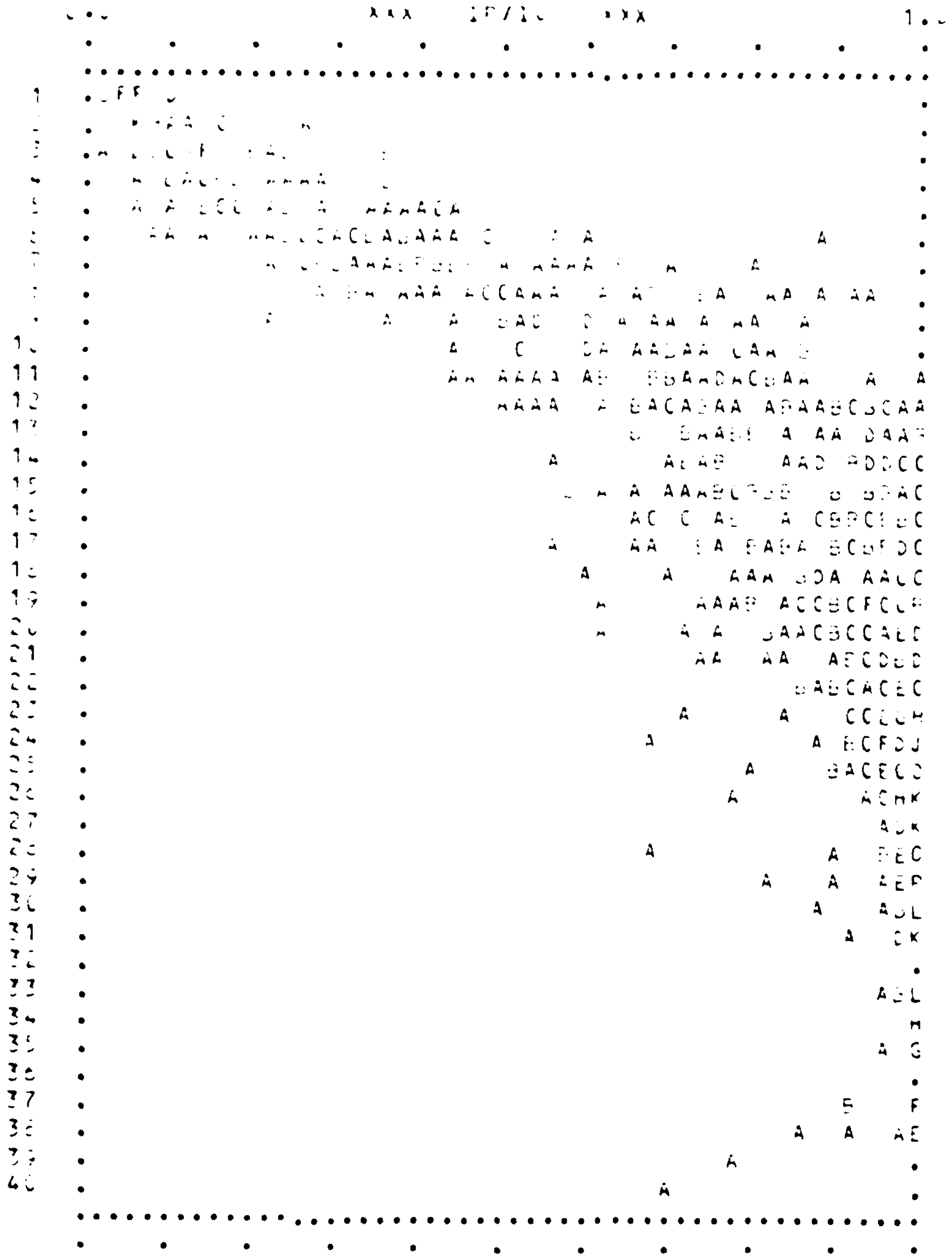

COMBINED RESULTS OF 39 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNFZ= 614.4: XMAG1=ALL : XNMIR=ALL



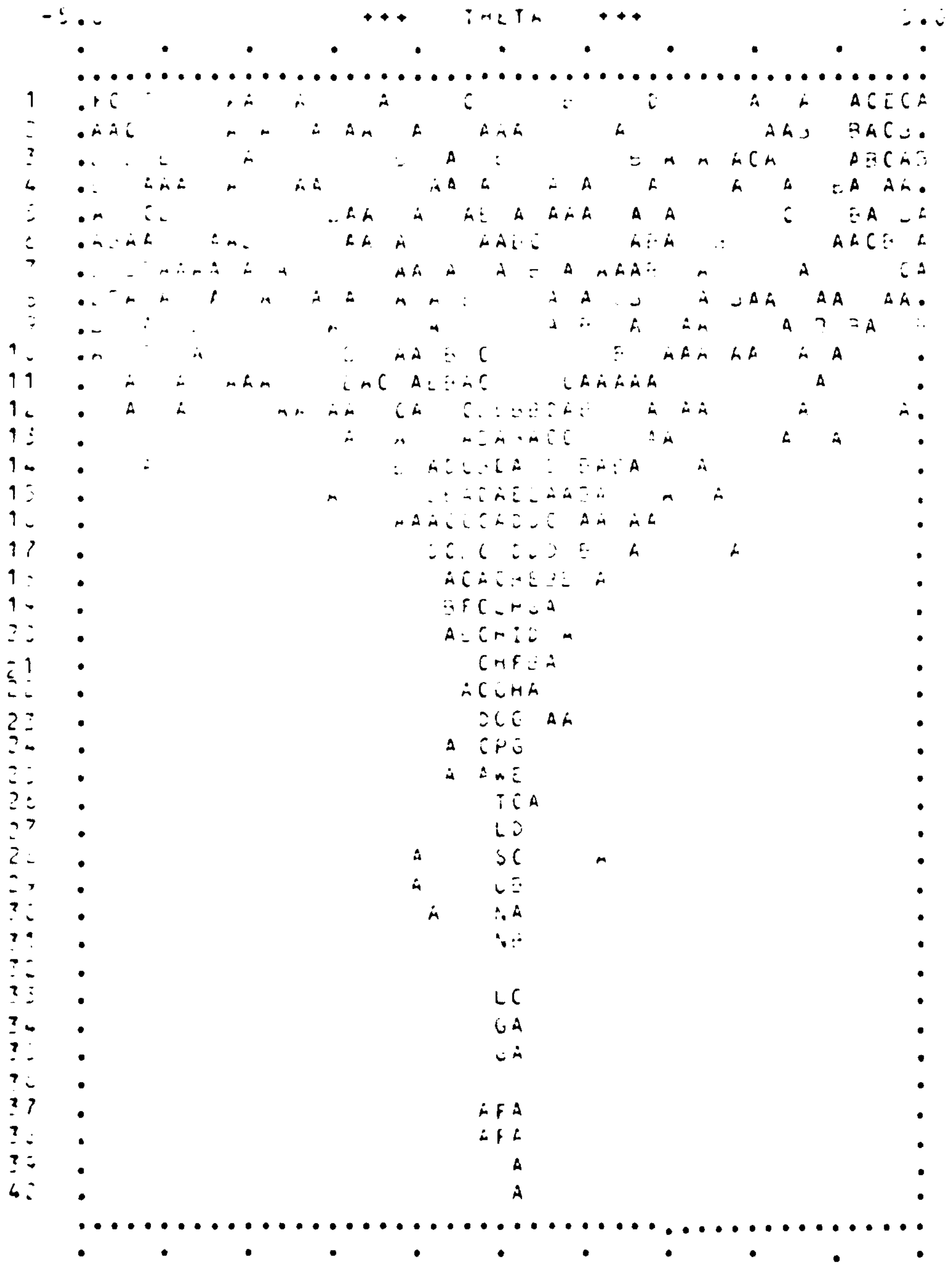
COMBINED RESULTS OF 22 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNF2= 1.200: XMAG1=ALL : XNMIR=ALL



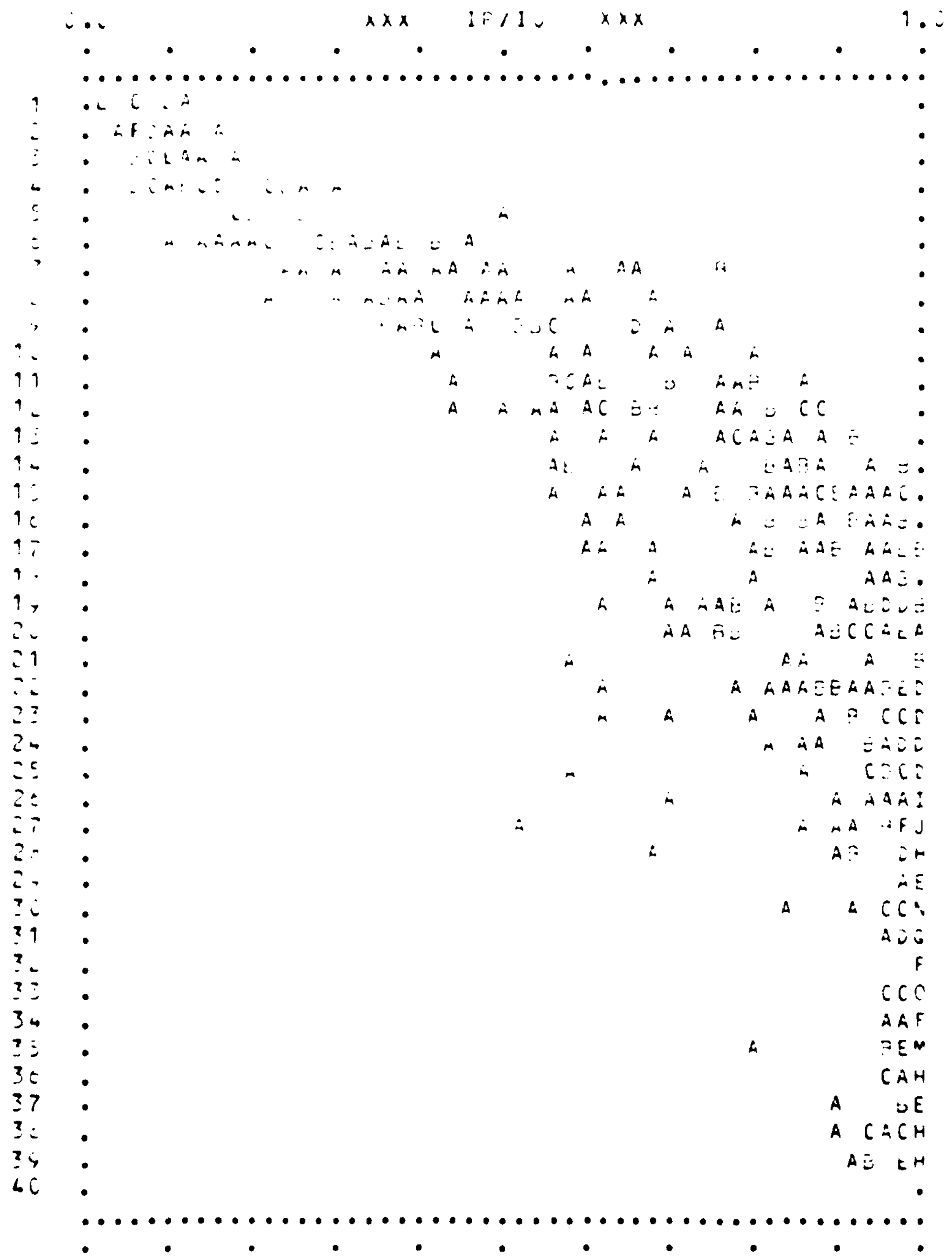

COMBINED RESULTS OF 22 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNF2= 1228.6: XMAG1=ALL : XNMIR=ALL



COMPILED RESULTS OF 29 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNFD=ALL : XMAG1= 1.31996: XNMIR=ALL

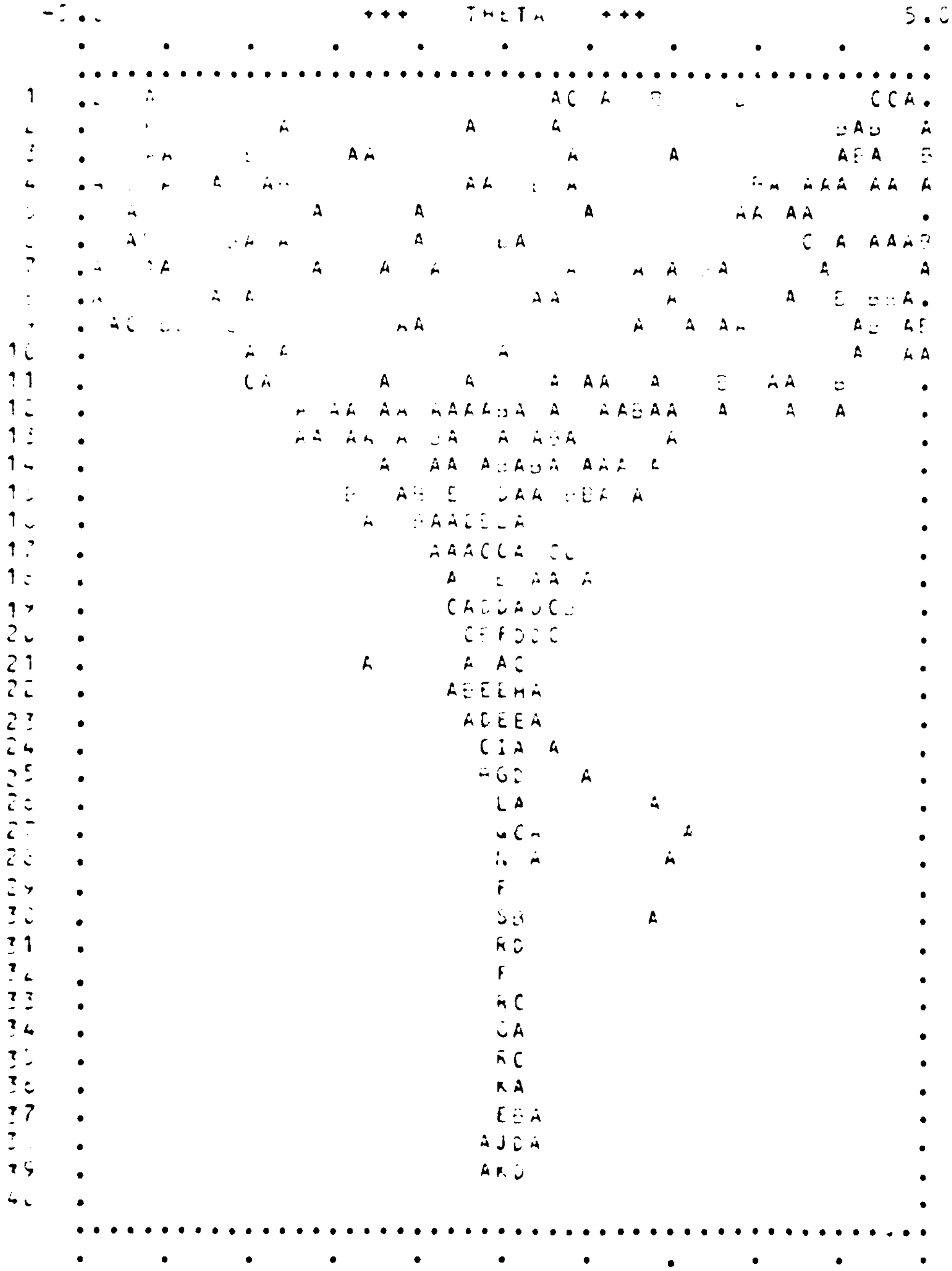



COMBINED RESULTS OF 29 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE Y-AXIS. APPEARANCE
OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT
MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT.
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNFI=ALL : XMAG1= 1.31996: XNMIR=ALL



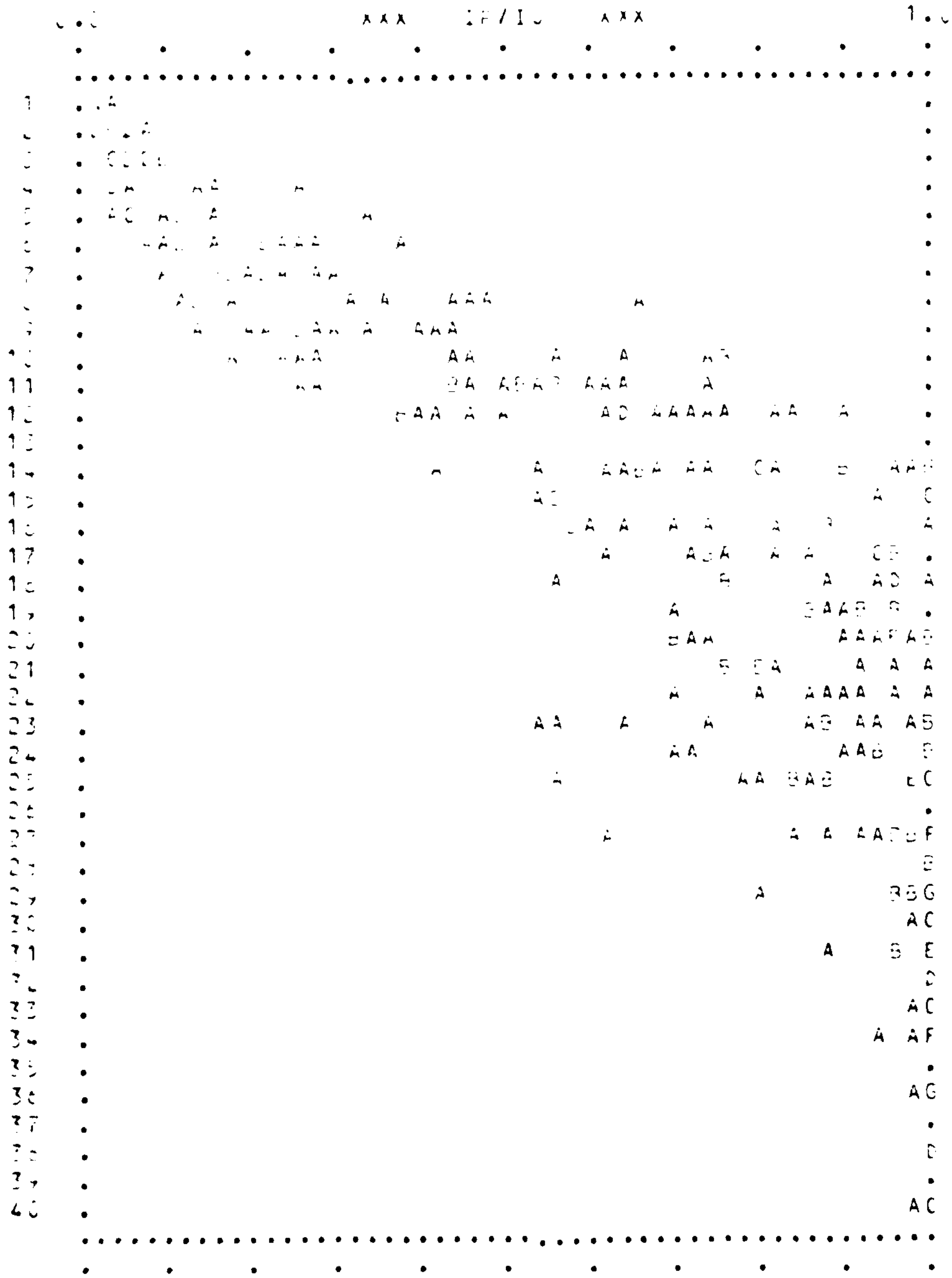
COMBINED RESULTS OF 22 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNFZ=ALL : XMAG1= 1.41417: XNMIR=ALL



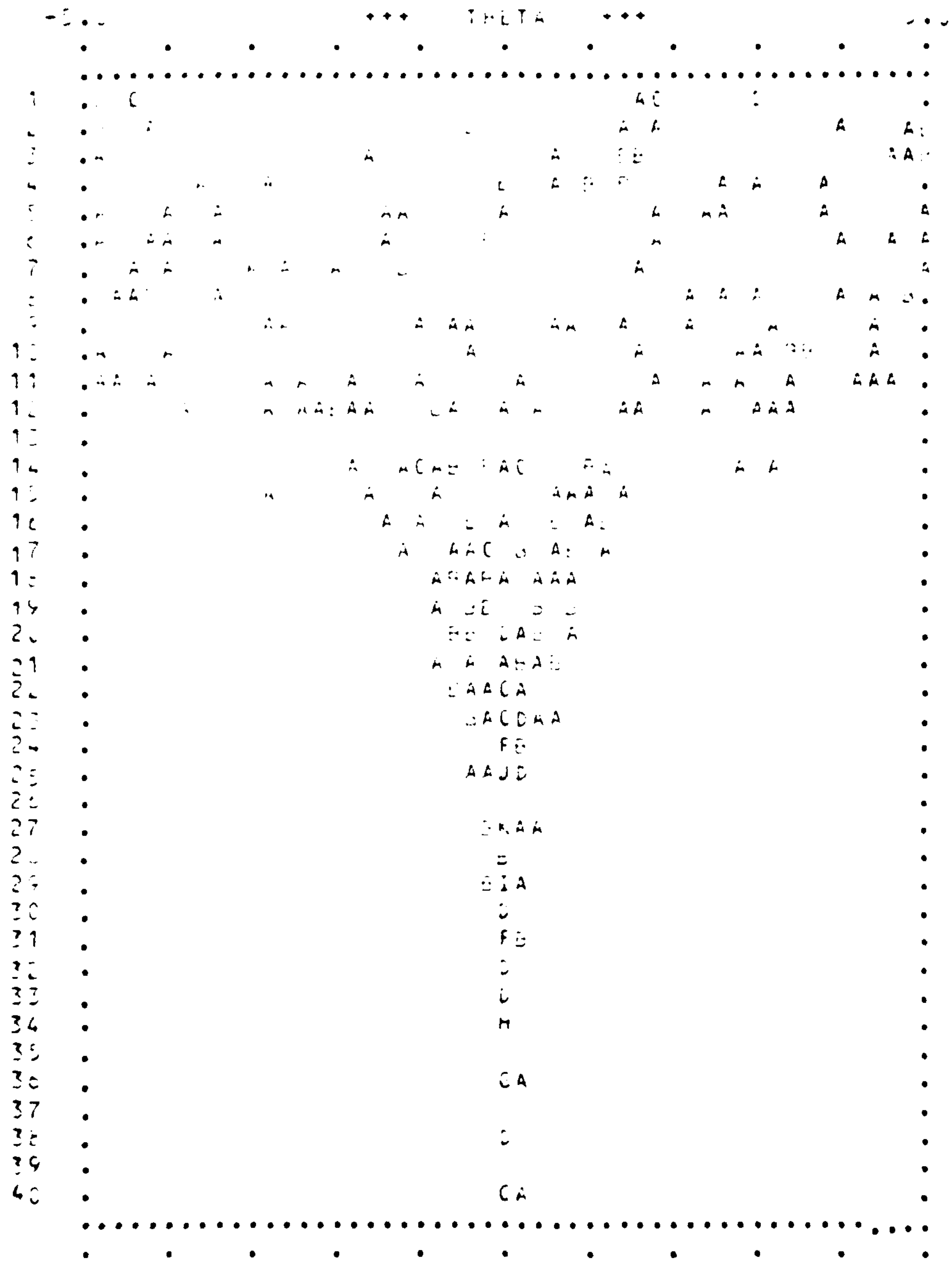

COMBINED RESULTS OF 2[illegible] COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 1.41417: XNMIR=ALL

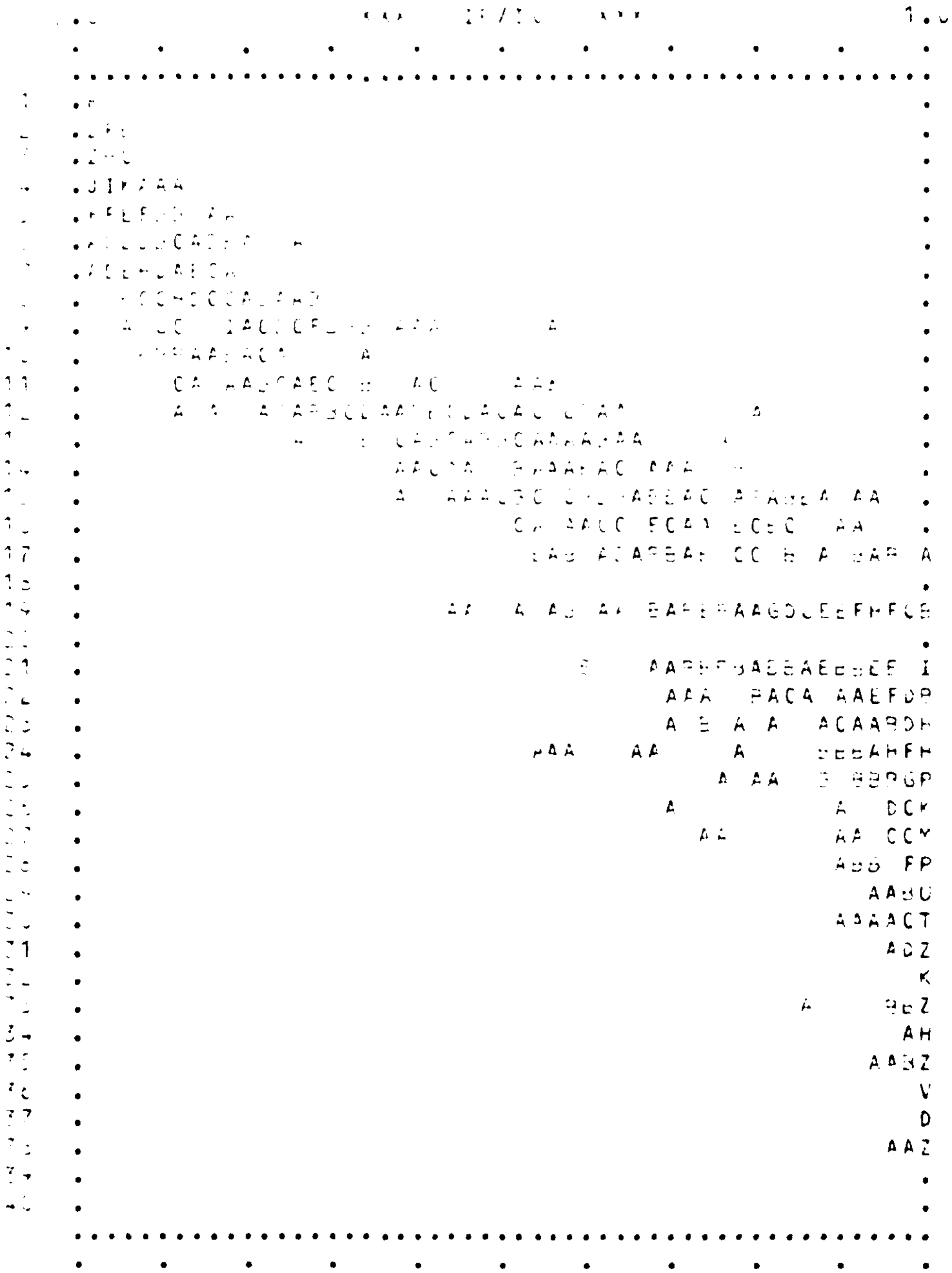


COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

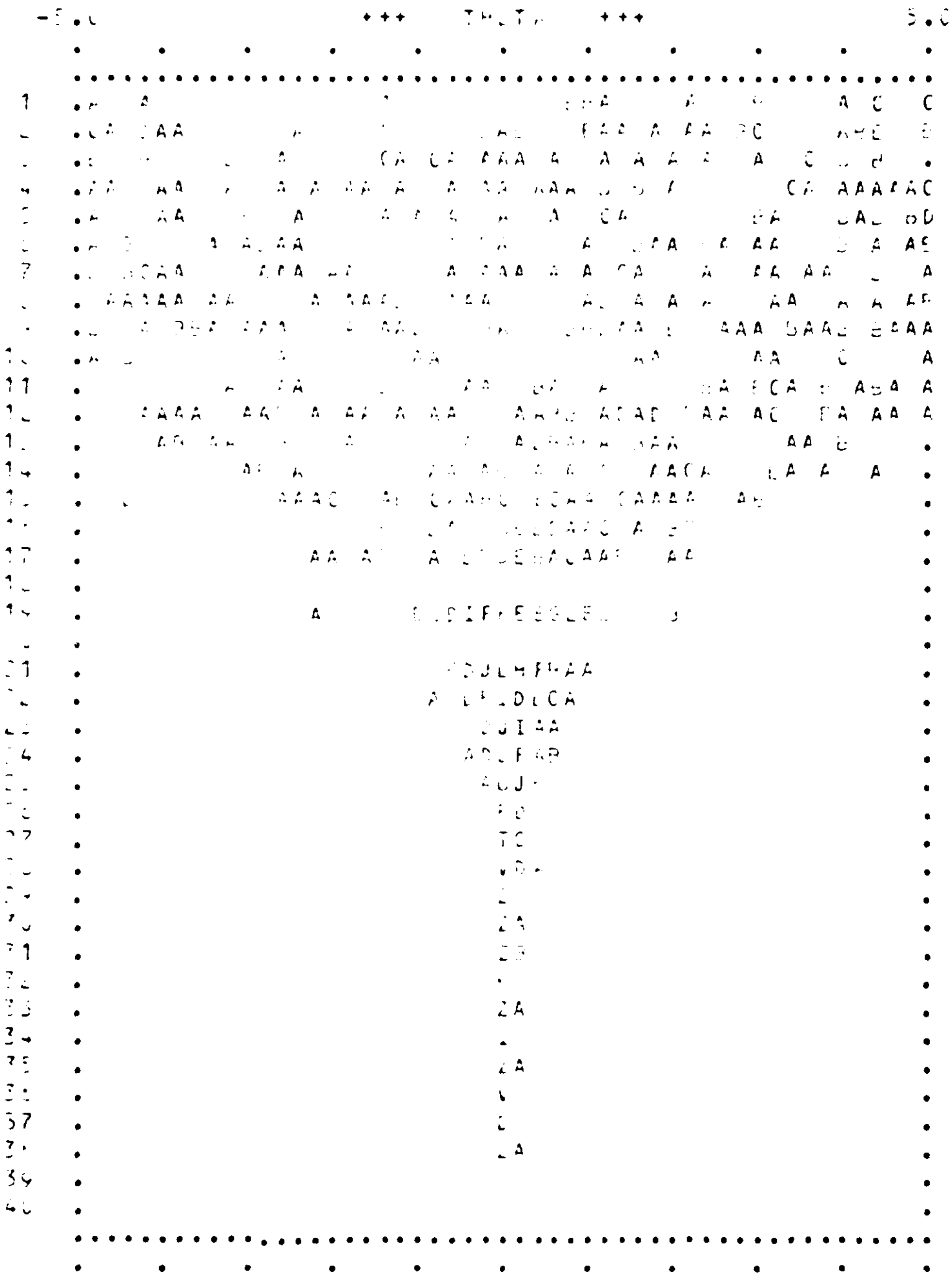
XNPC=ALL : XMACT= 1.5574E: XNMIR=ALL




COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE
OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT
MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT.
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNFC=ALL : XMAC1= 1.58740: XNMIR=ALL

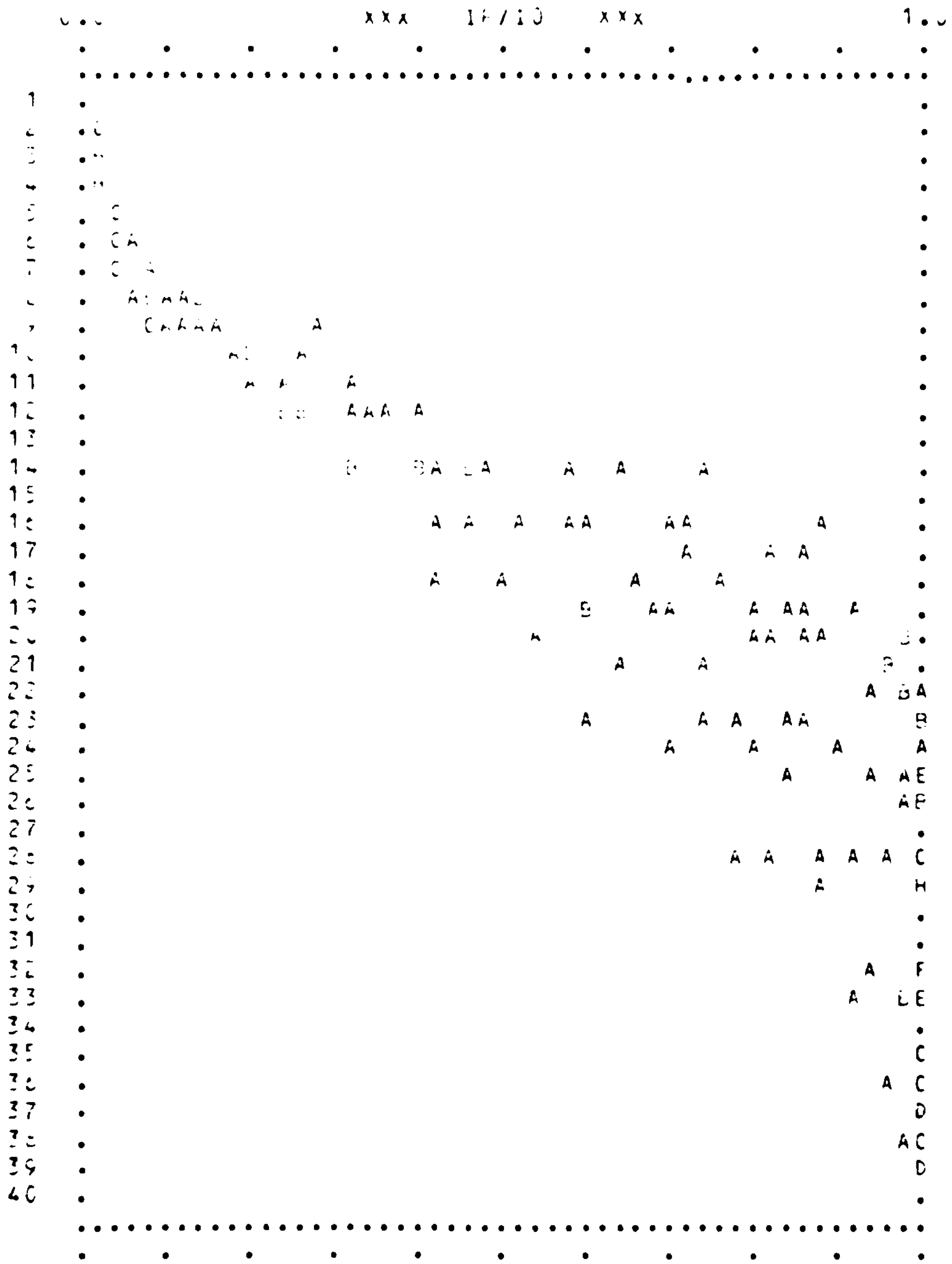


COMBINED RESULTS OF 75 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNFZ=ALL : YMAG1= 2.0000: XNMIR=ALL

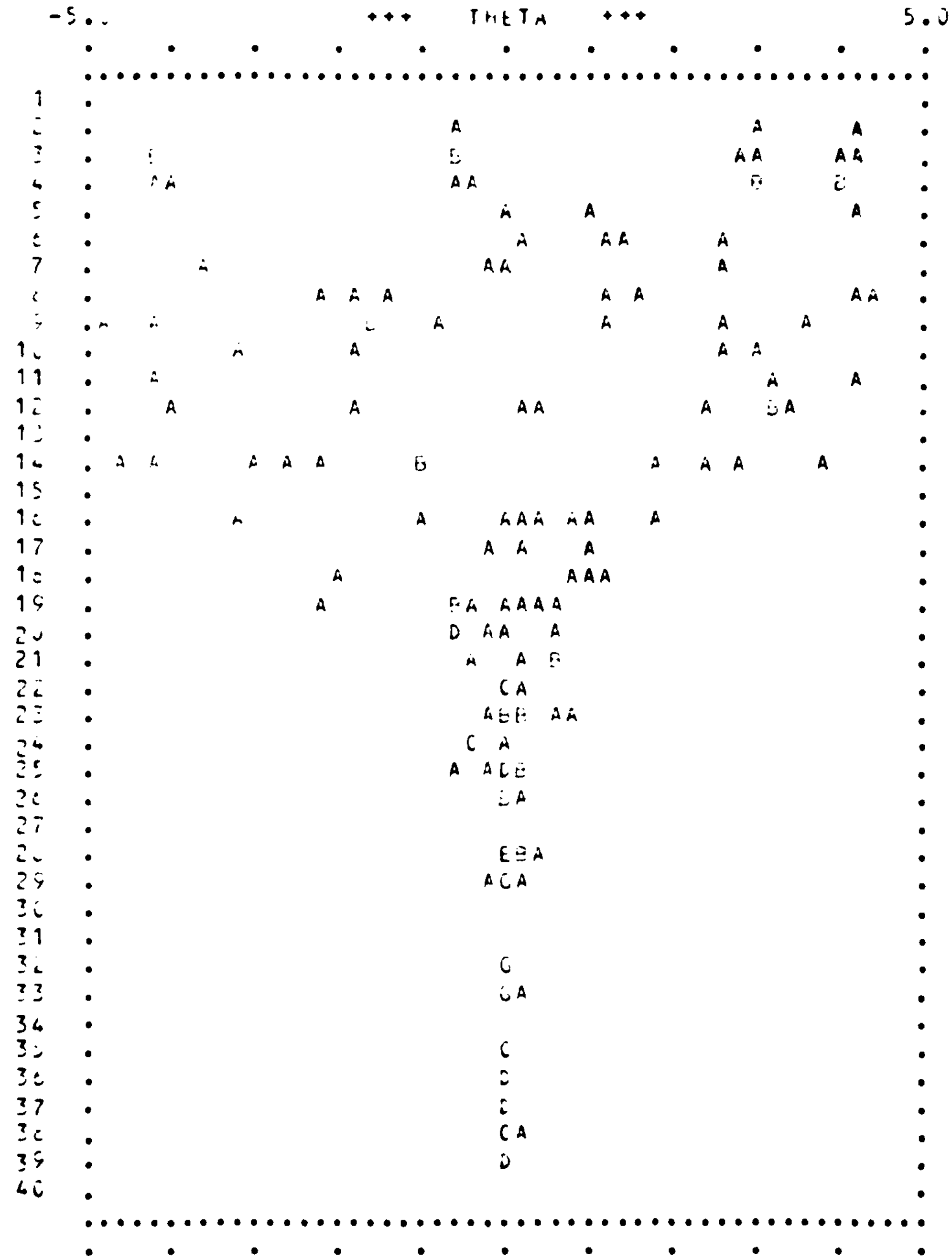



COMBINED RESULTS OF 75 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE Y-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 2.00000: XNMIS=ALL

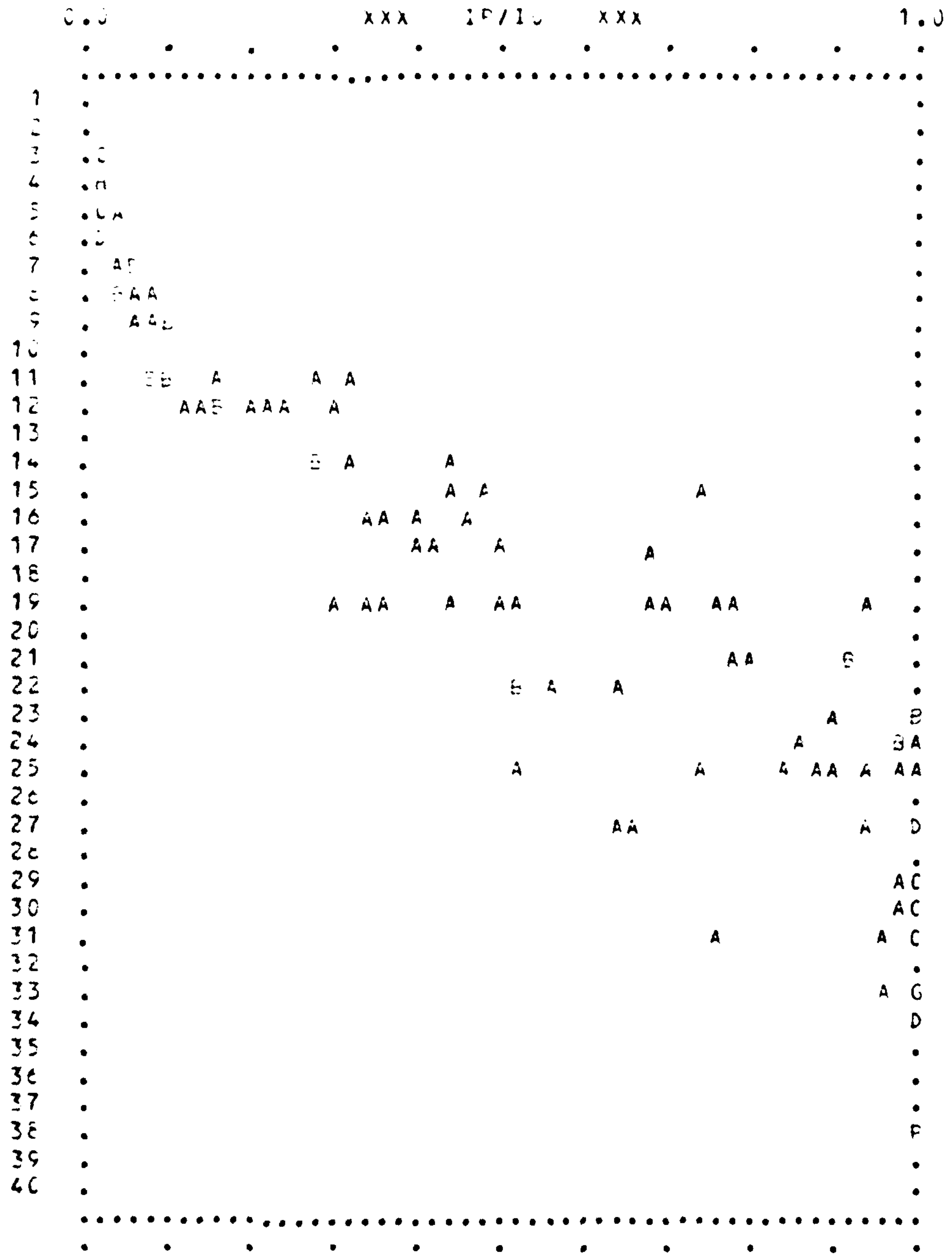



COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNFD=ALL : XMAG1= 2.52840: XNMIR=ALL



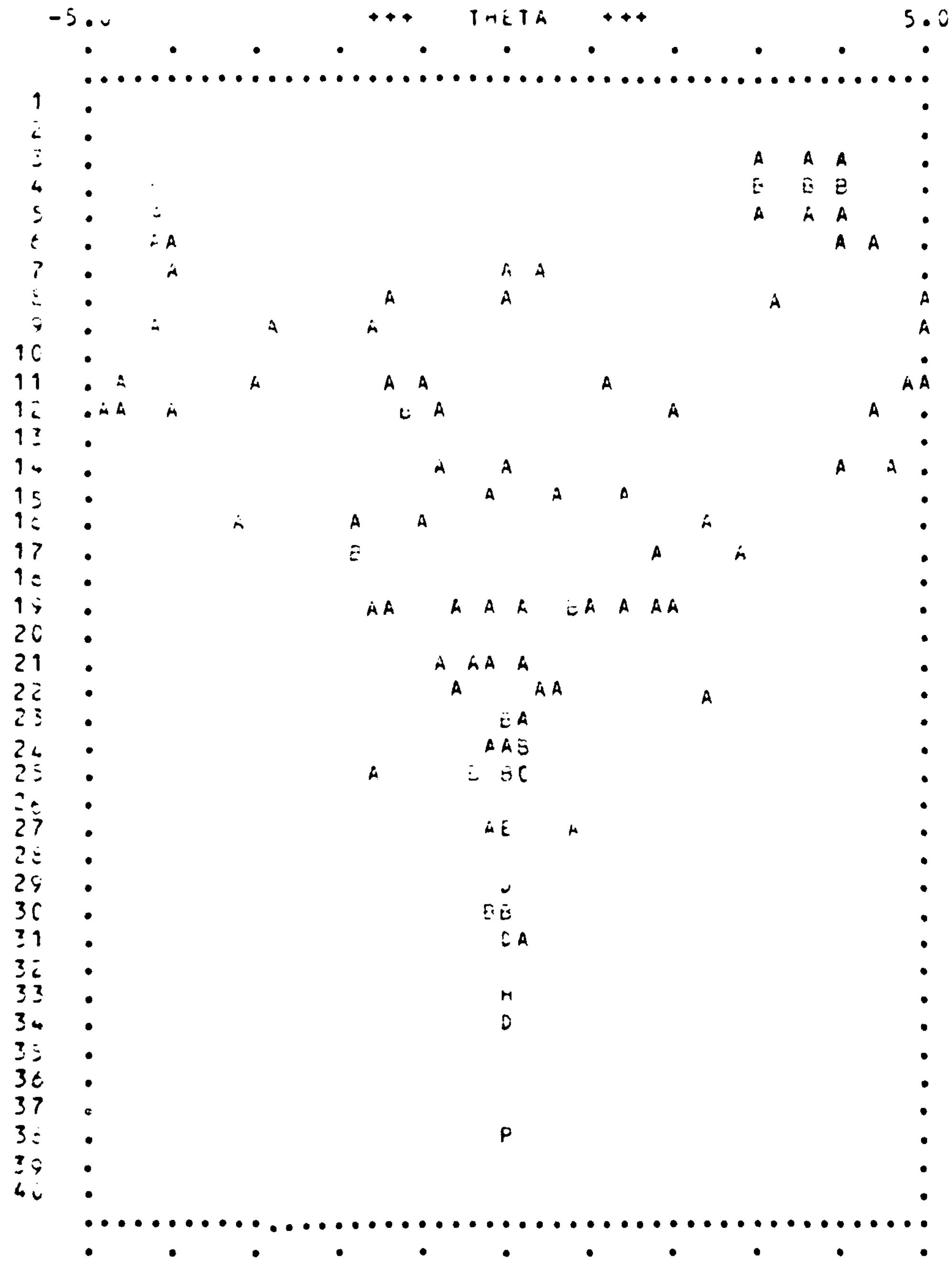

COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 2.82840: XNMIR=ALL




COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 4.00002: XNMIR=ALL

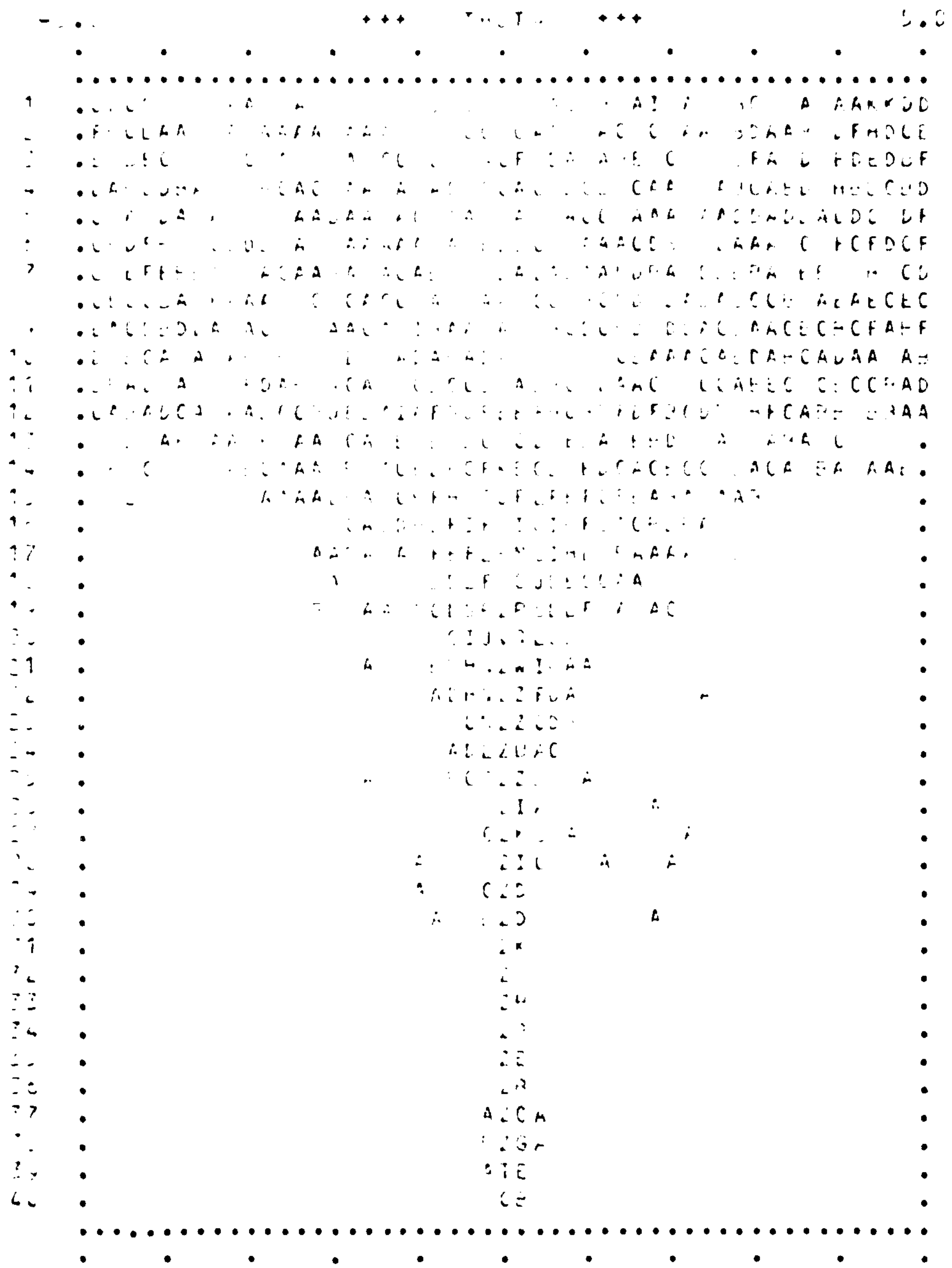



COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 4.00002: XNMIR=ALL

COMBINED RESULTS OF 195 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE Y-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

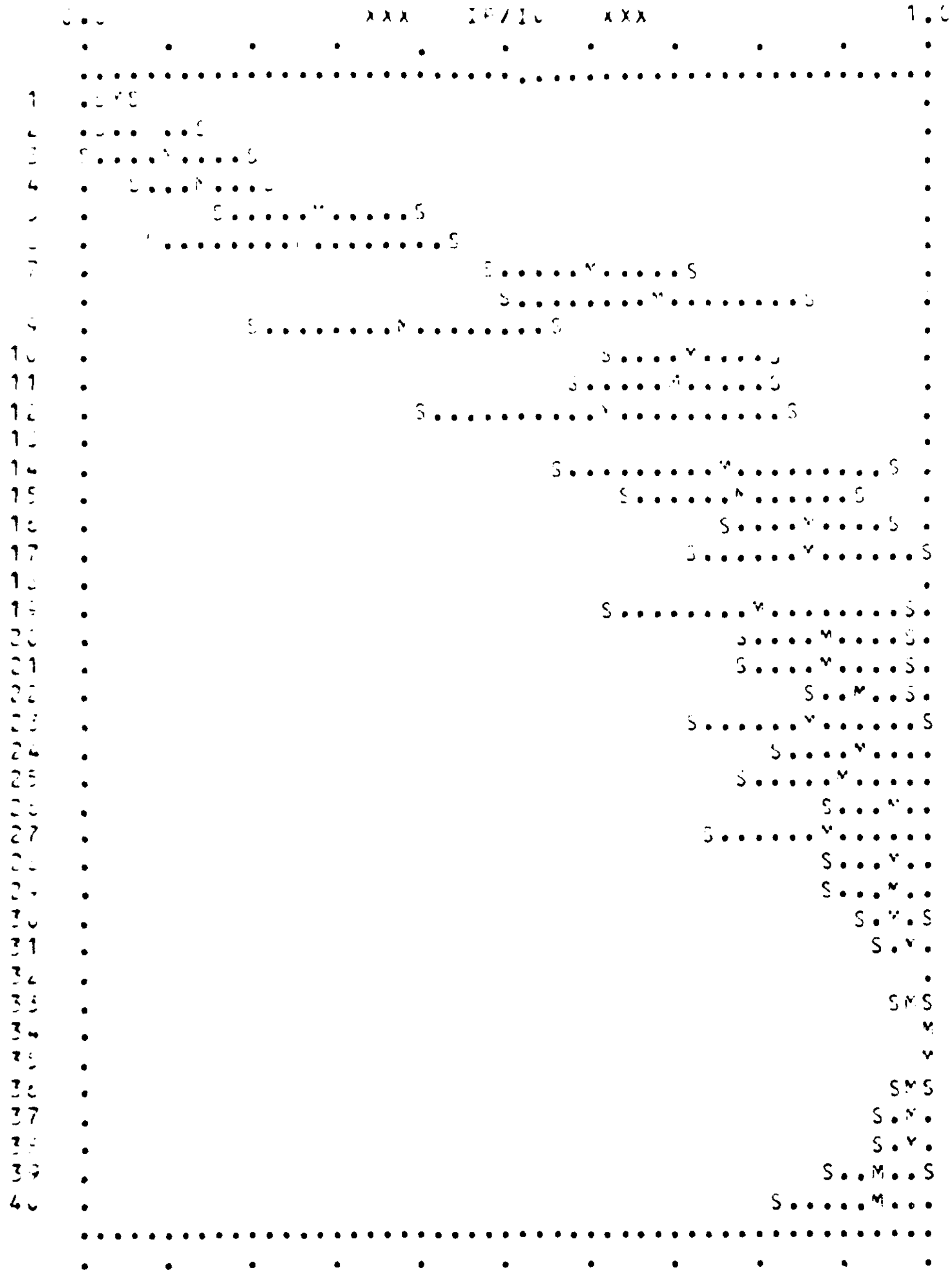
XNF3=ALL : XMAG1=ALL : XNMIR=ALL



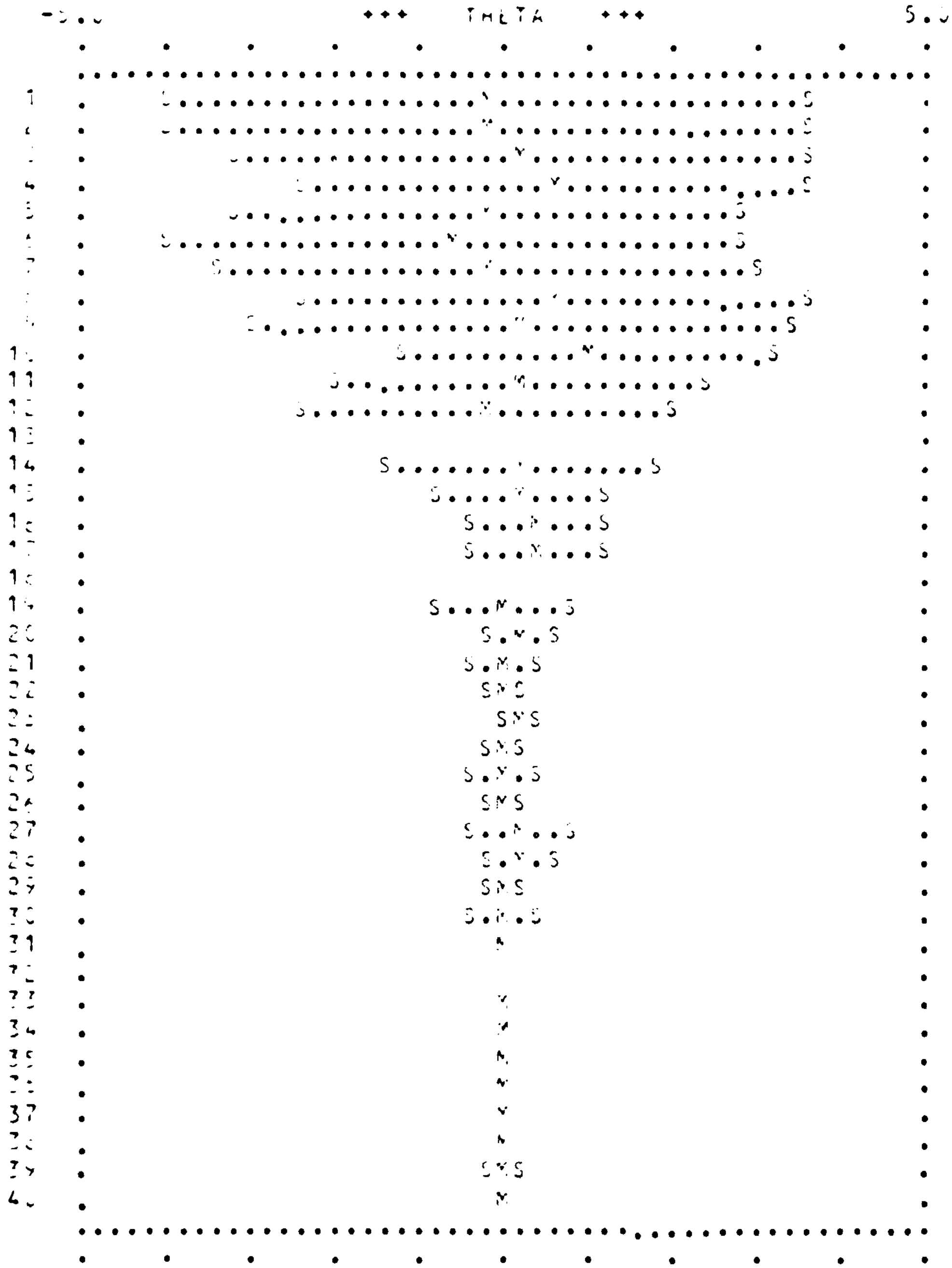
COMBINED RESULTS OF 19[illegible] COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO [illegible] UNITS ON THE Y-AXIS. APPEARANCE OF CHARACTERS BEYOND 'A' IN ALPHABET INDICATES THAT MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT. RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XMF2=ALL : XMAC1=ALL : XNMIR=ALL

XI. STATISTICAL ANALYSIS OF RESULTS OF MODE FORMATION CALCULATIONS WITH SPECIFIED INPUT PARAMETERS

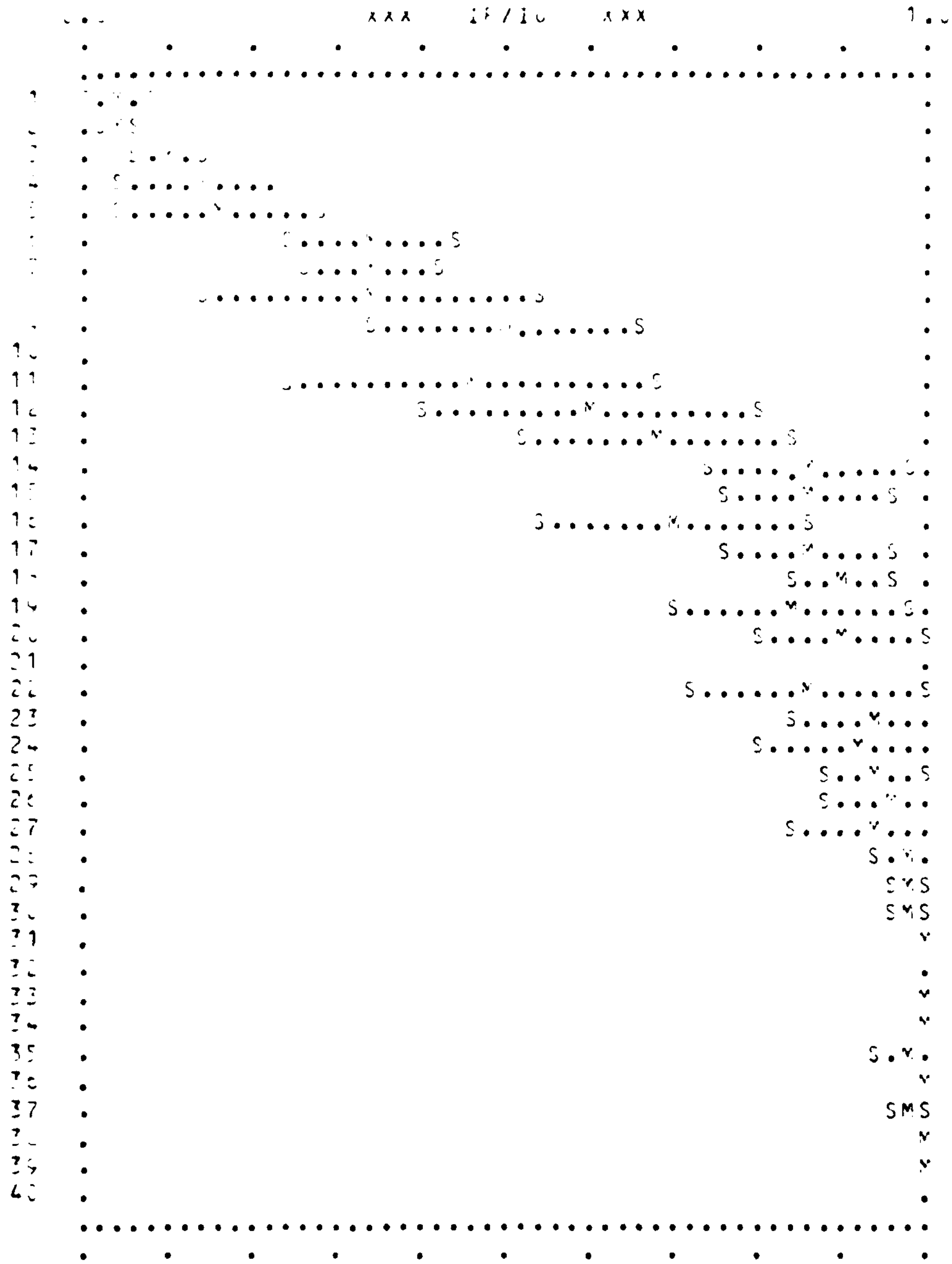


COMBINED RESULTS OF 41 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNF2= 70.0: XMAG1=ALL : XMMIR=ALL



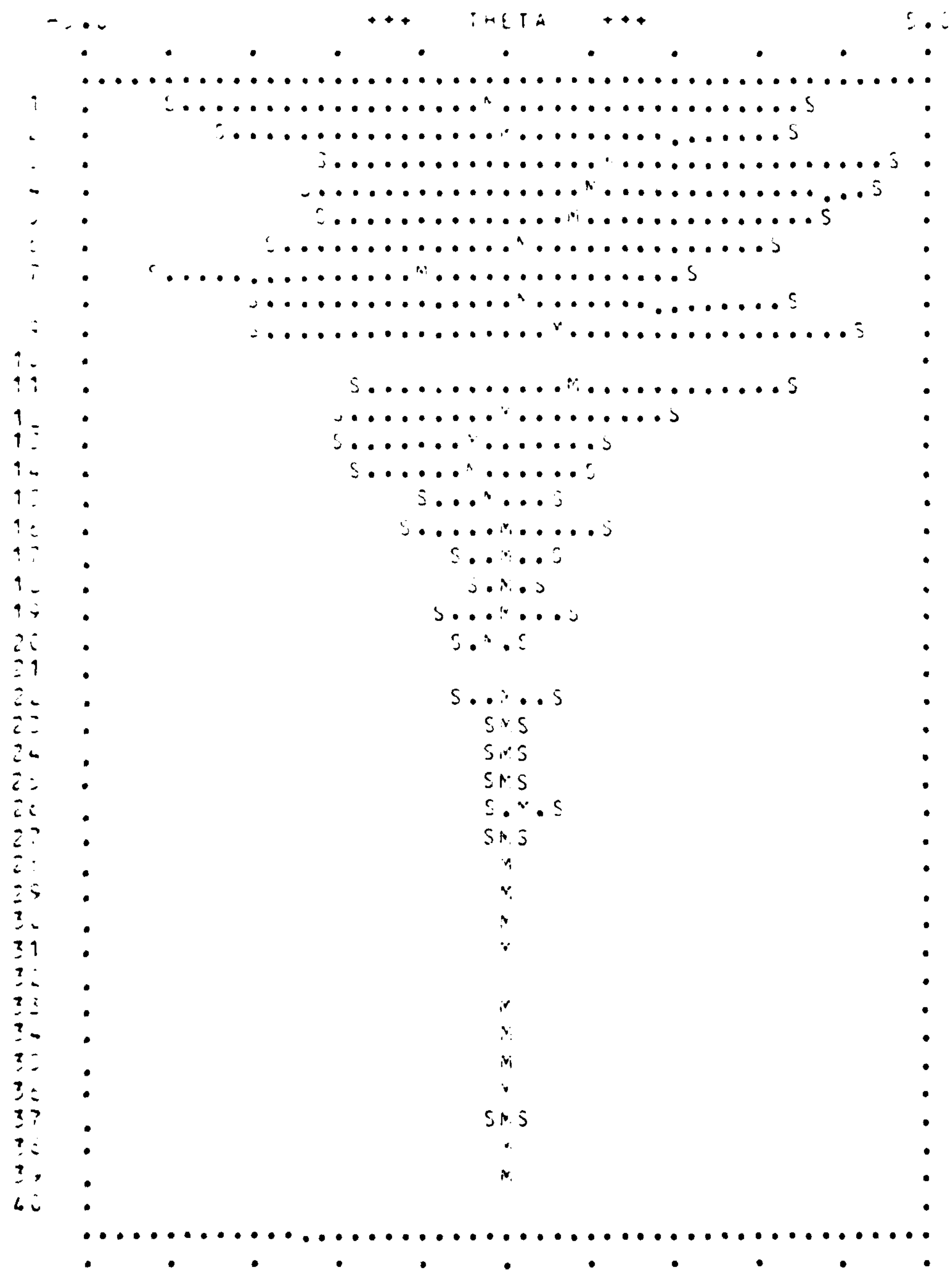

COMBINED RESULTS OF 41 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNFZ= 70.0: XNAG1=ALL : XNMIR=ALL



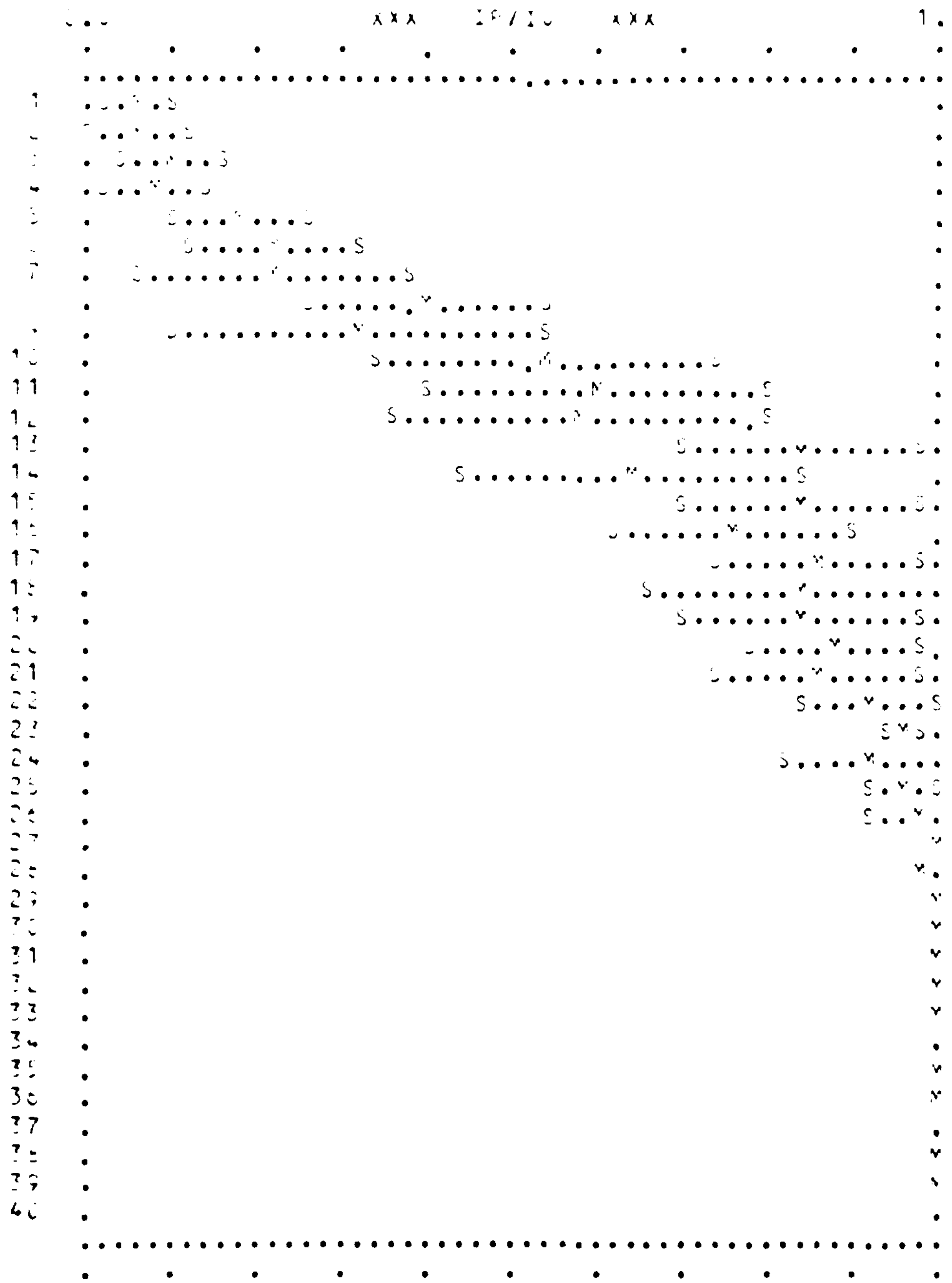
COMBINED RESULTS OF 42 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNRD= 150.0: XMAU1=ALL : XNMIR=ALL



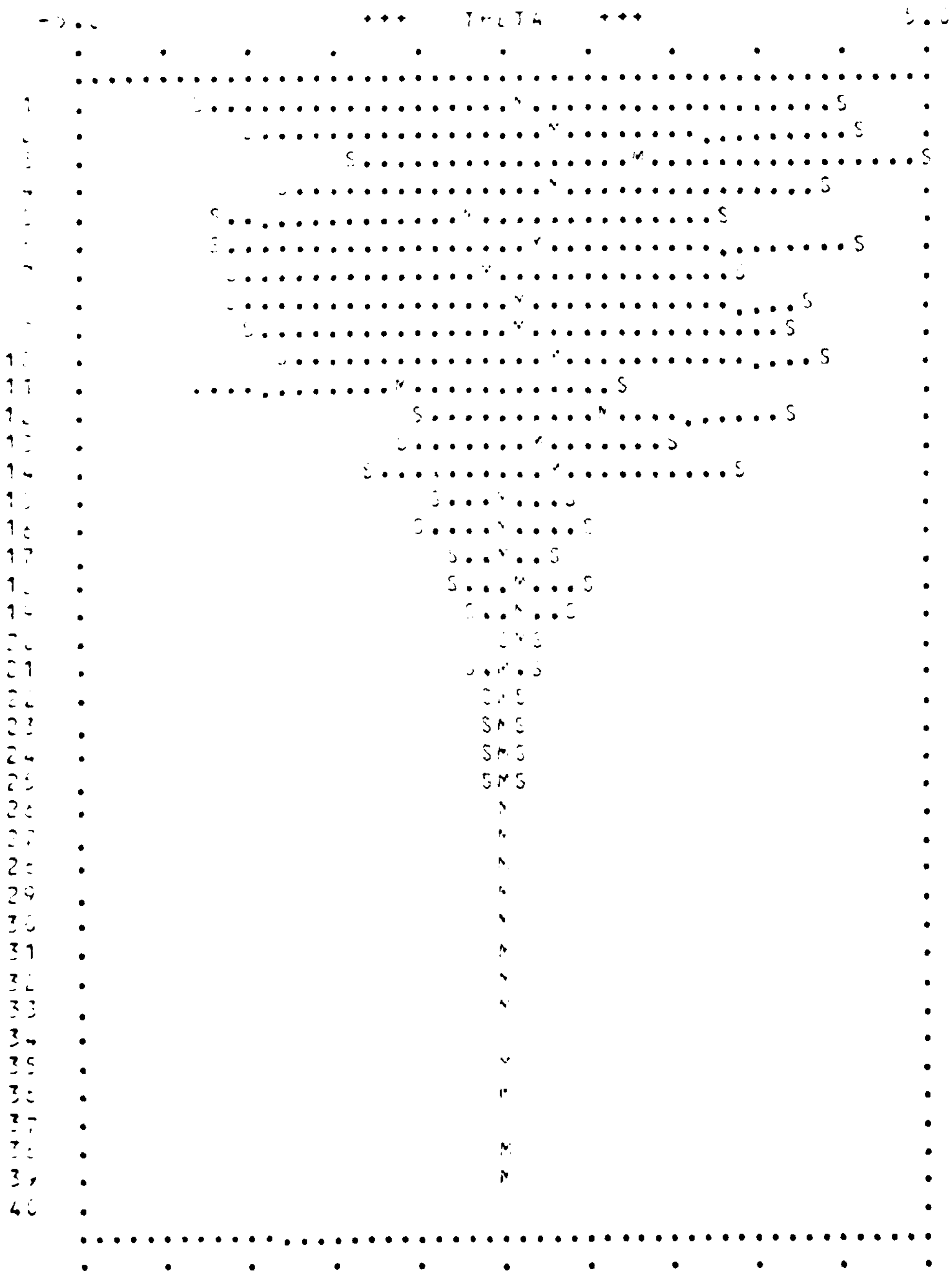

COMBINED RESULTS OF 42 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2= 153.0 : XMAG1=ALL : XNMIR=ALL

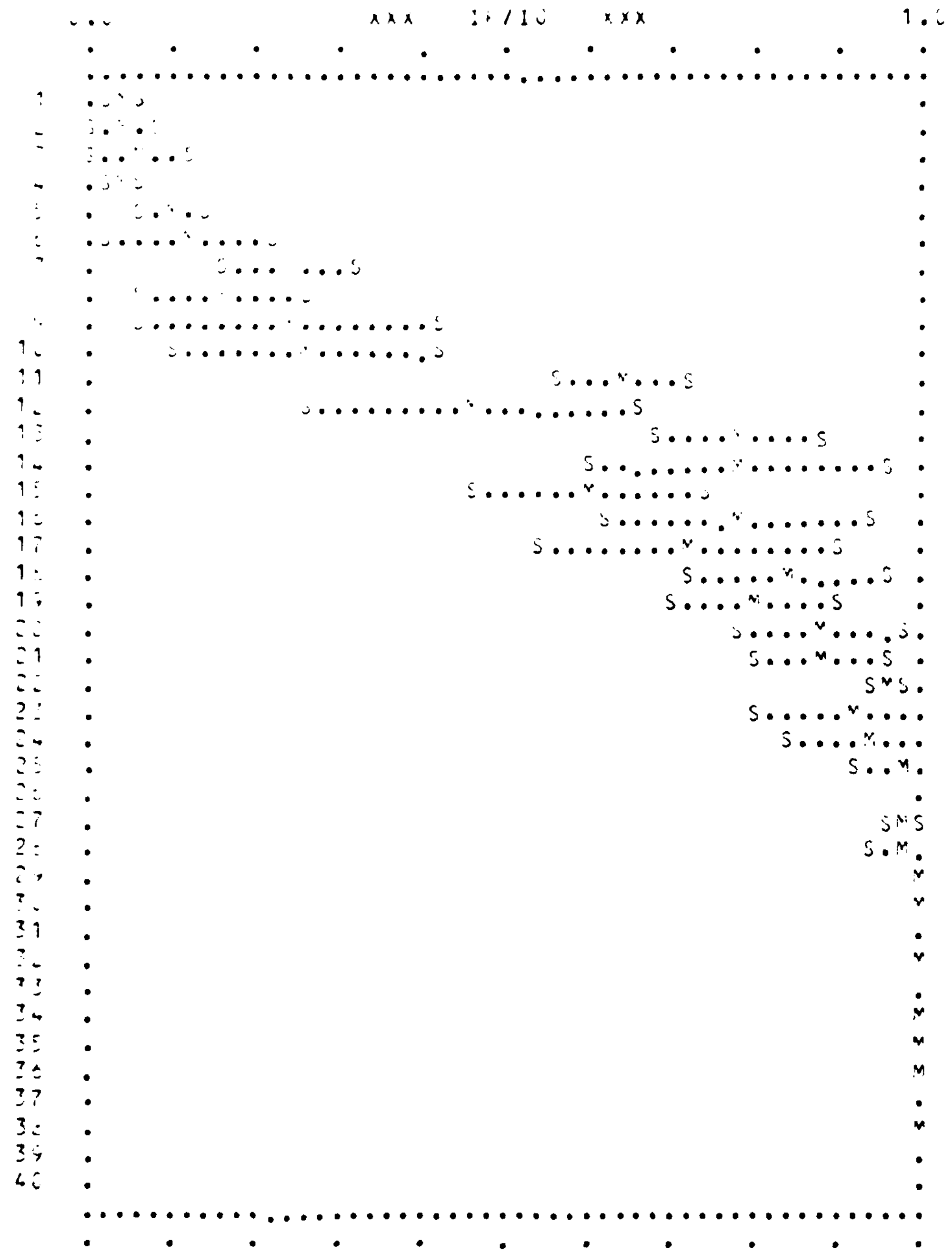



COMBINED RESULTS OF 43 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

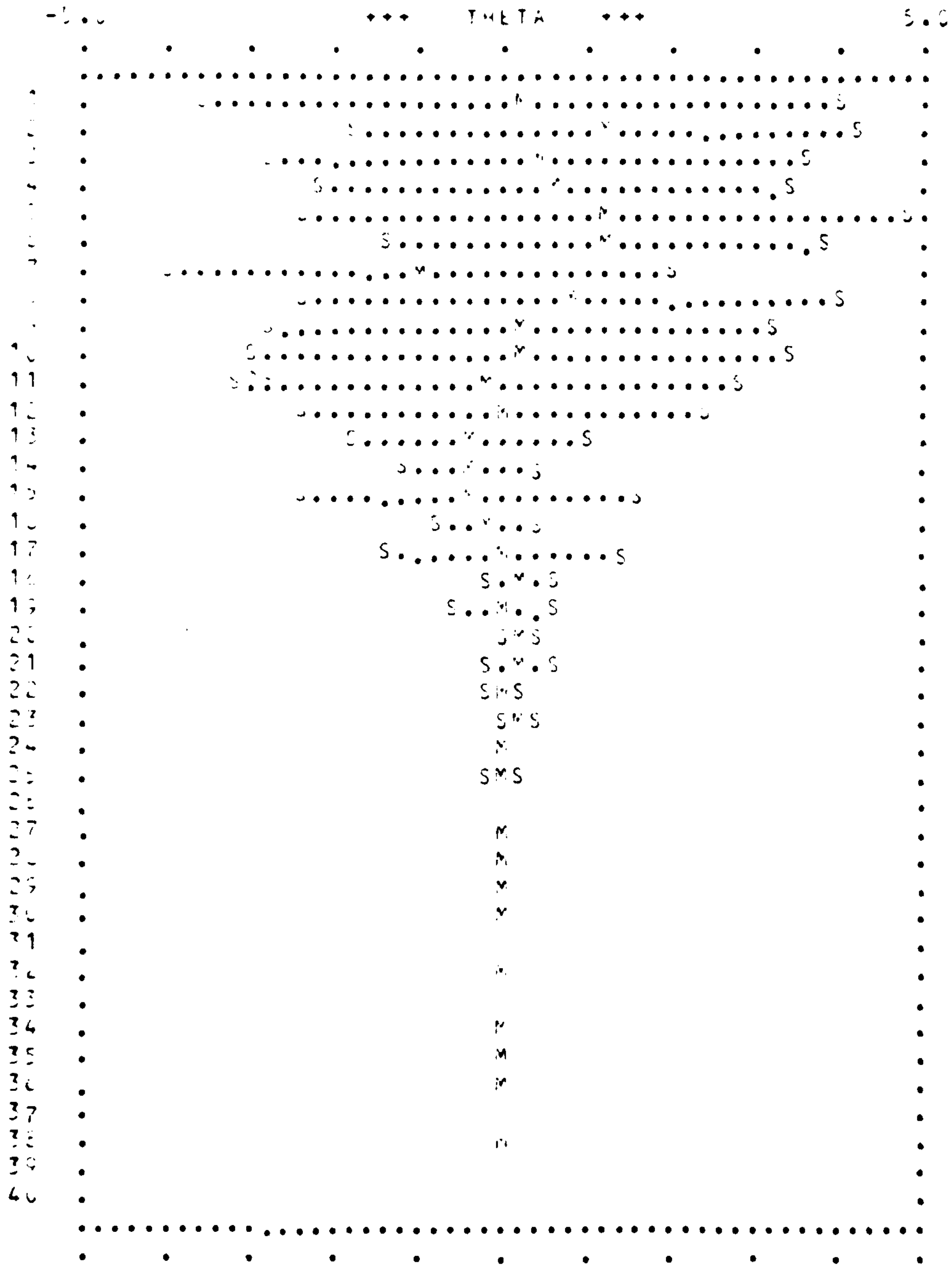
XWFO= [illegible]07.0: XMAG1=ALL : XNMIR=ALL




COMBINED RESULTS OF 43 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNF2= 207.2: XMACT=ALL : XNMIF=ALL

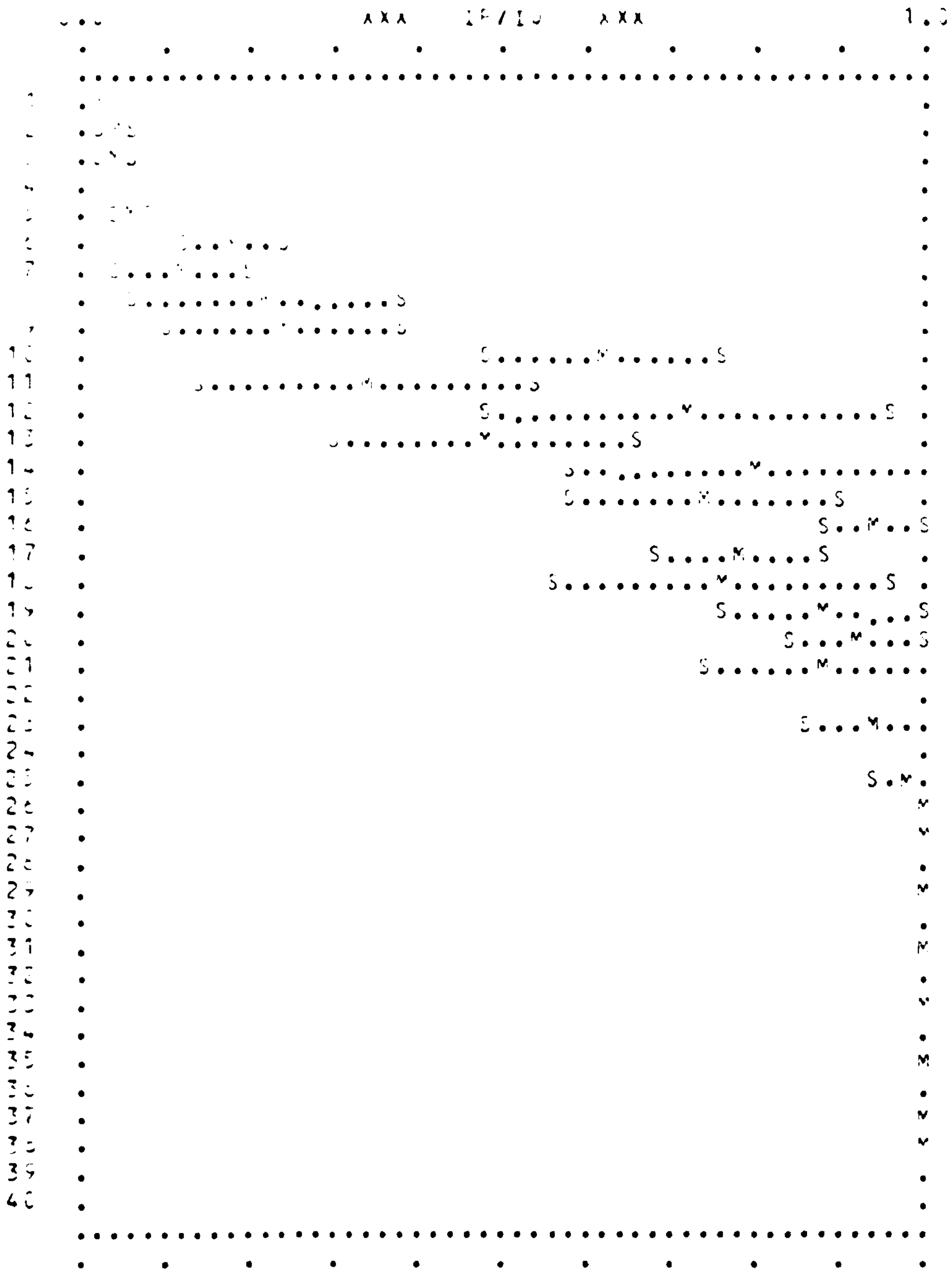


COMBINED RESULTS OF 29 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN
IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE
STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS
INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS).
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNFC= 614.4: XMAG1=ALL : XNMIR=ALL

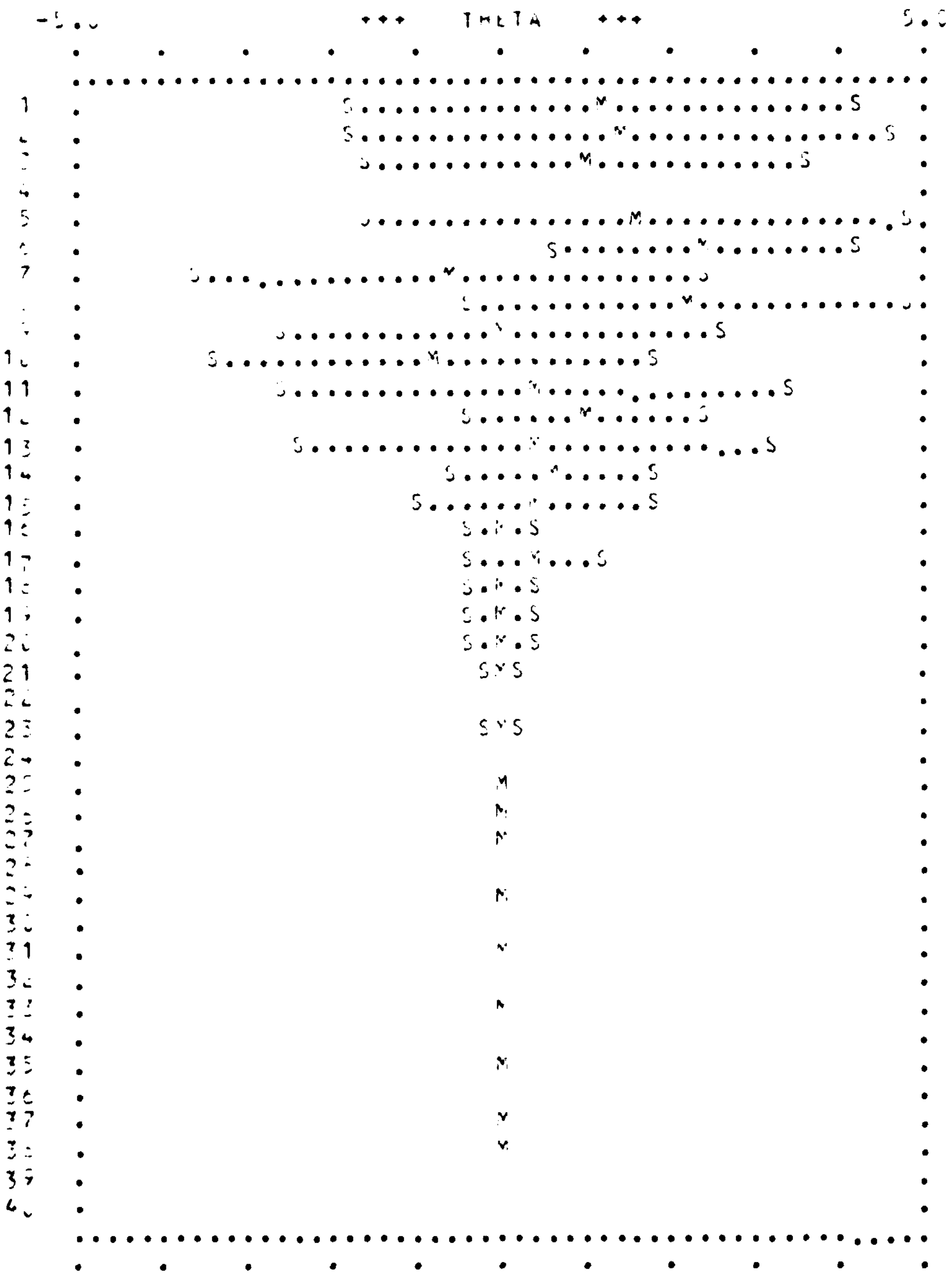



COMBINED RESULTS OF 29 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2= 014.4: XMAG1=ALL : XNYIR=ALL

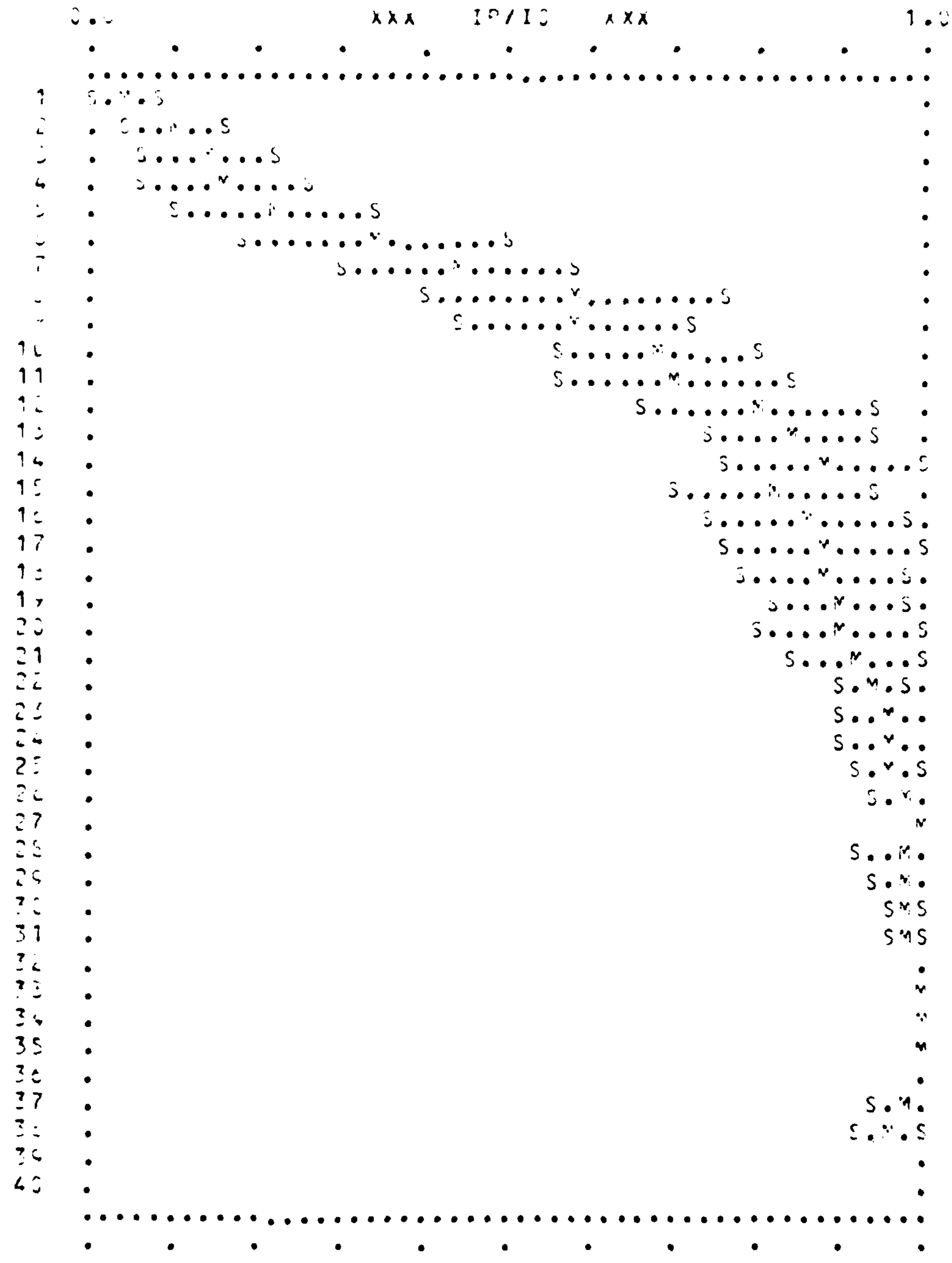


COMBINED RESULTS OF 22 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN
IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE
STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS
INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS).
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNFI= 122?.5: XMAC1=ALL : XNMIR=ALL



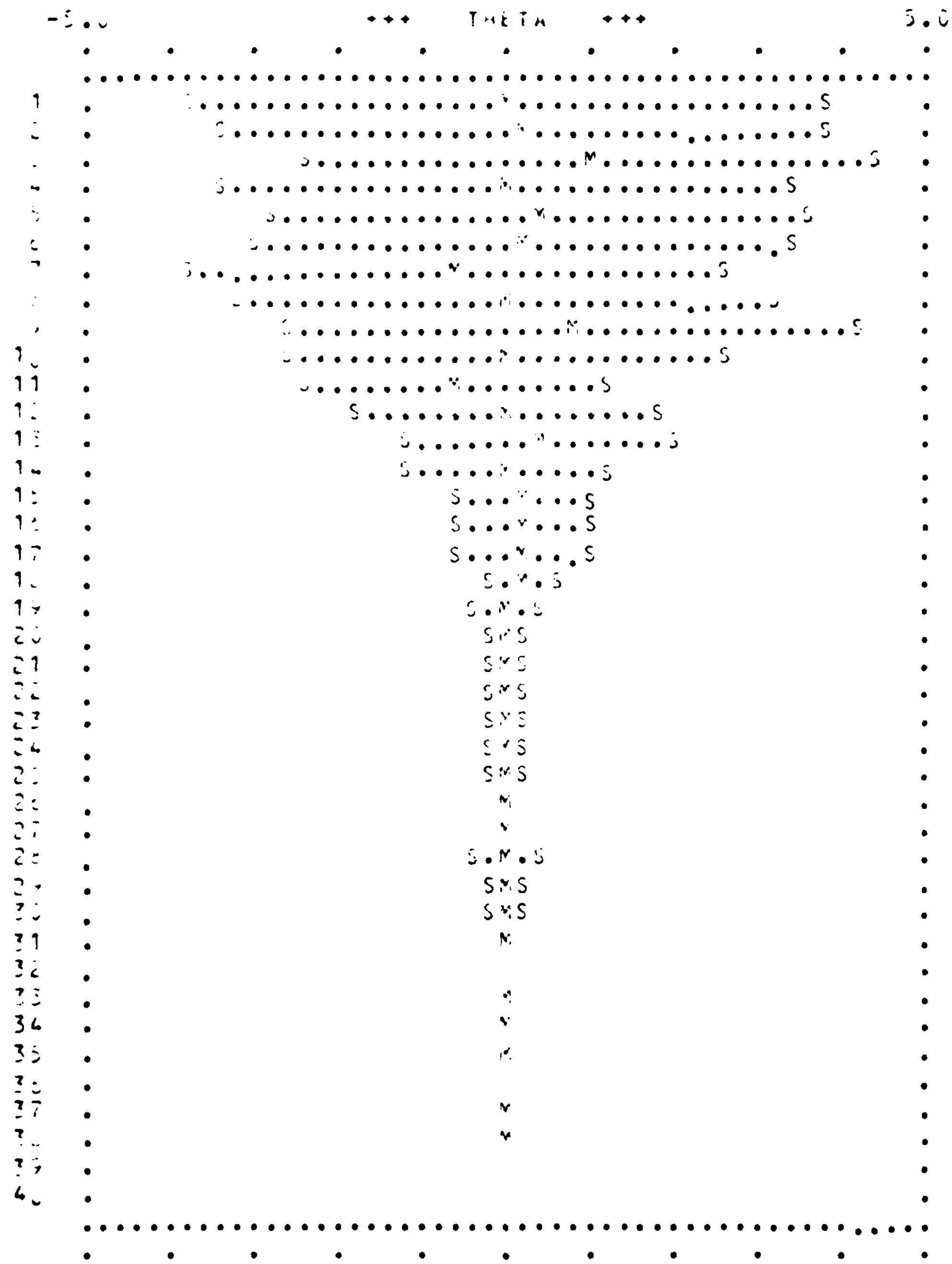

COMBINED RESULTS OF 22 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNFD= 1026.8: XMAG1=ALL : XNMIR=ALL



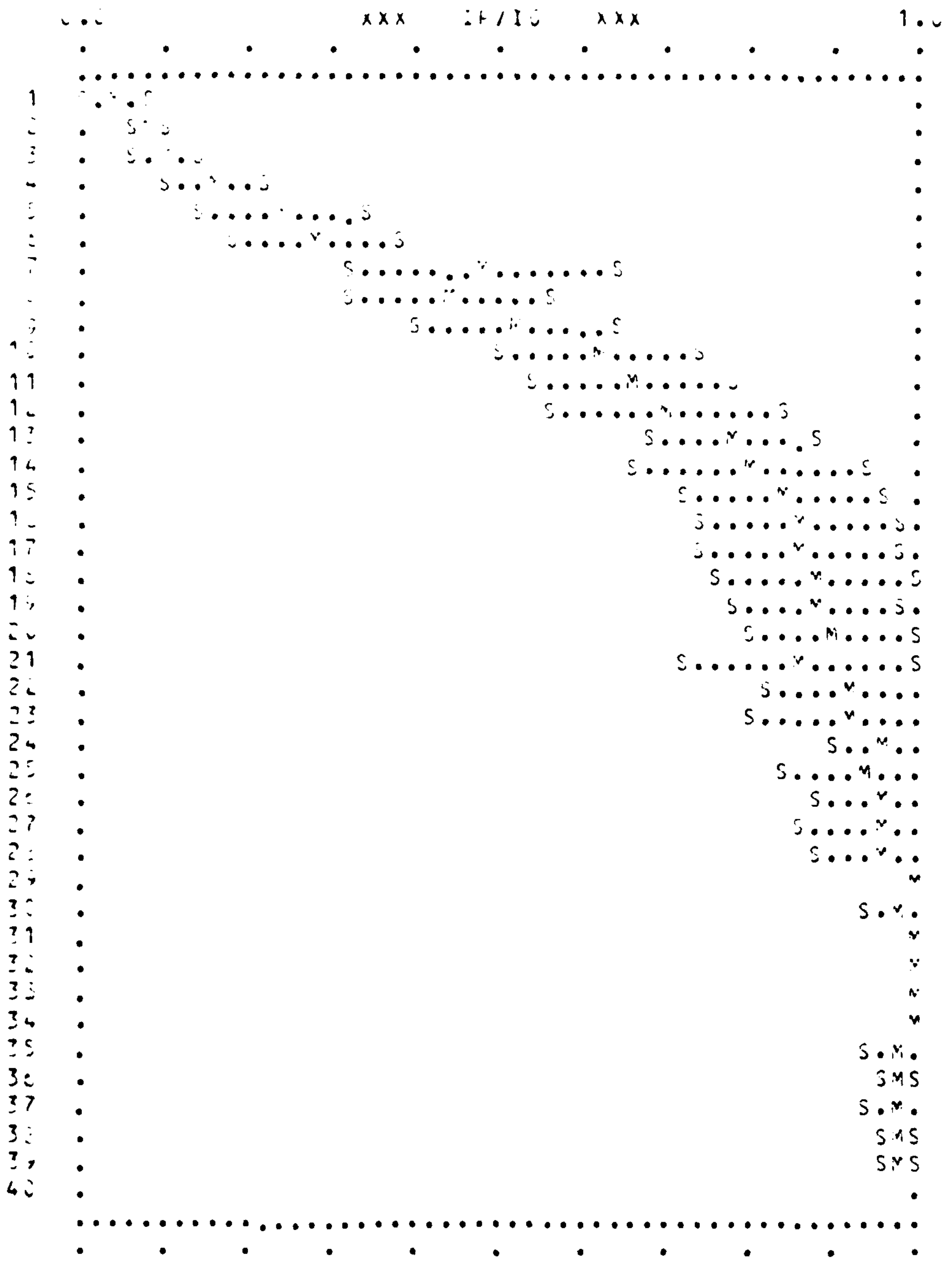

COMBINED RESULTS OF 29 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 1.31996: XNMIR=ALL

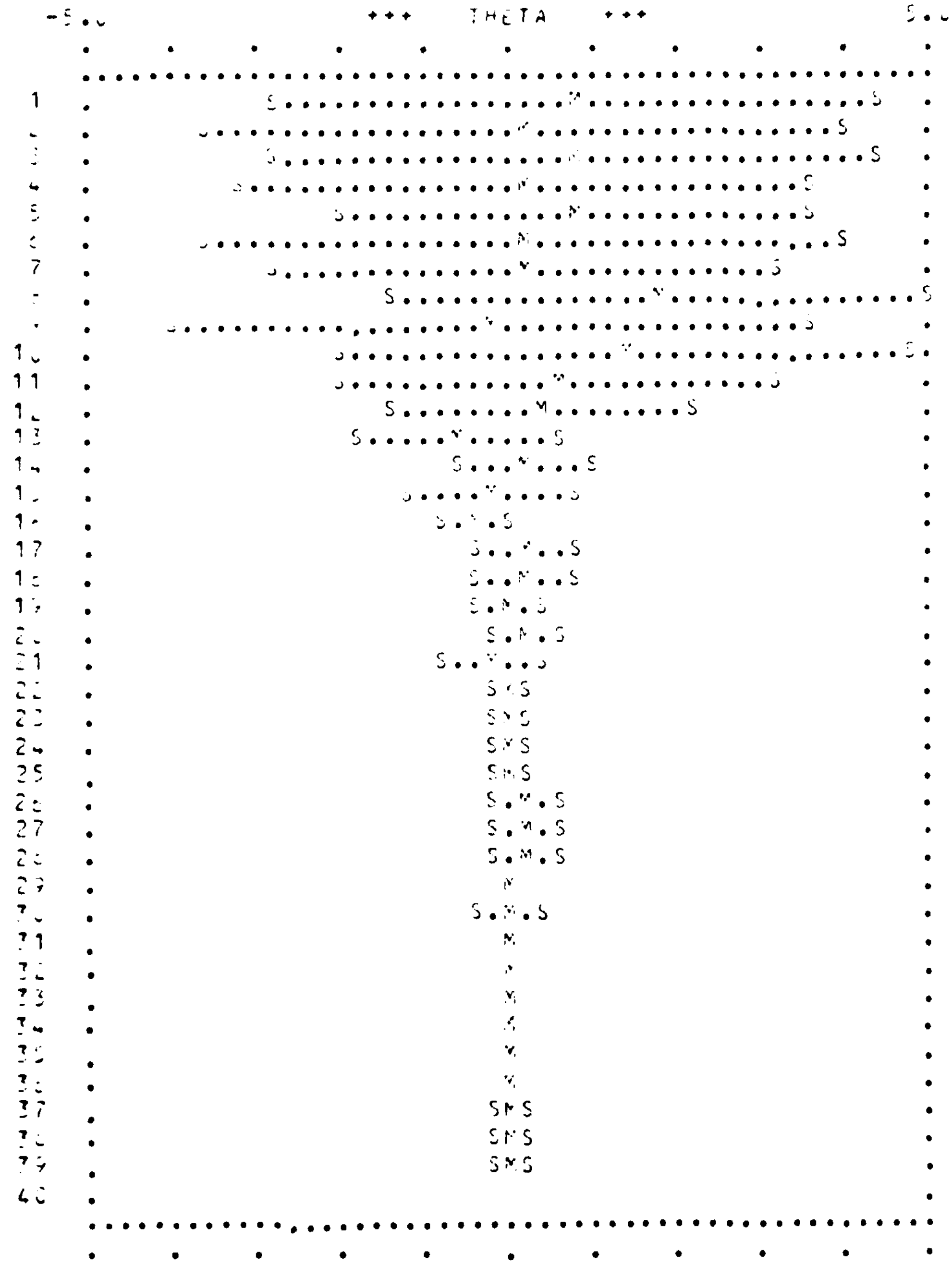



COMBINED RESULTS OF 29 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNFD=ALL : XMAG1= 1.31996: XNMIR=ALL

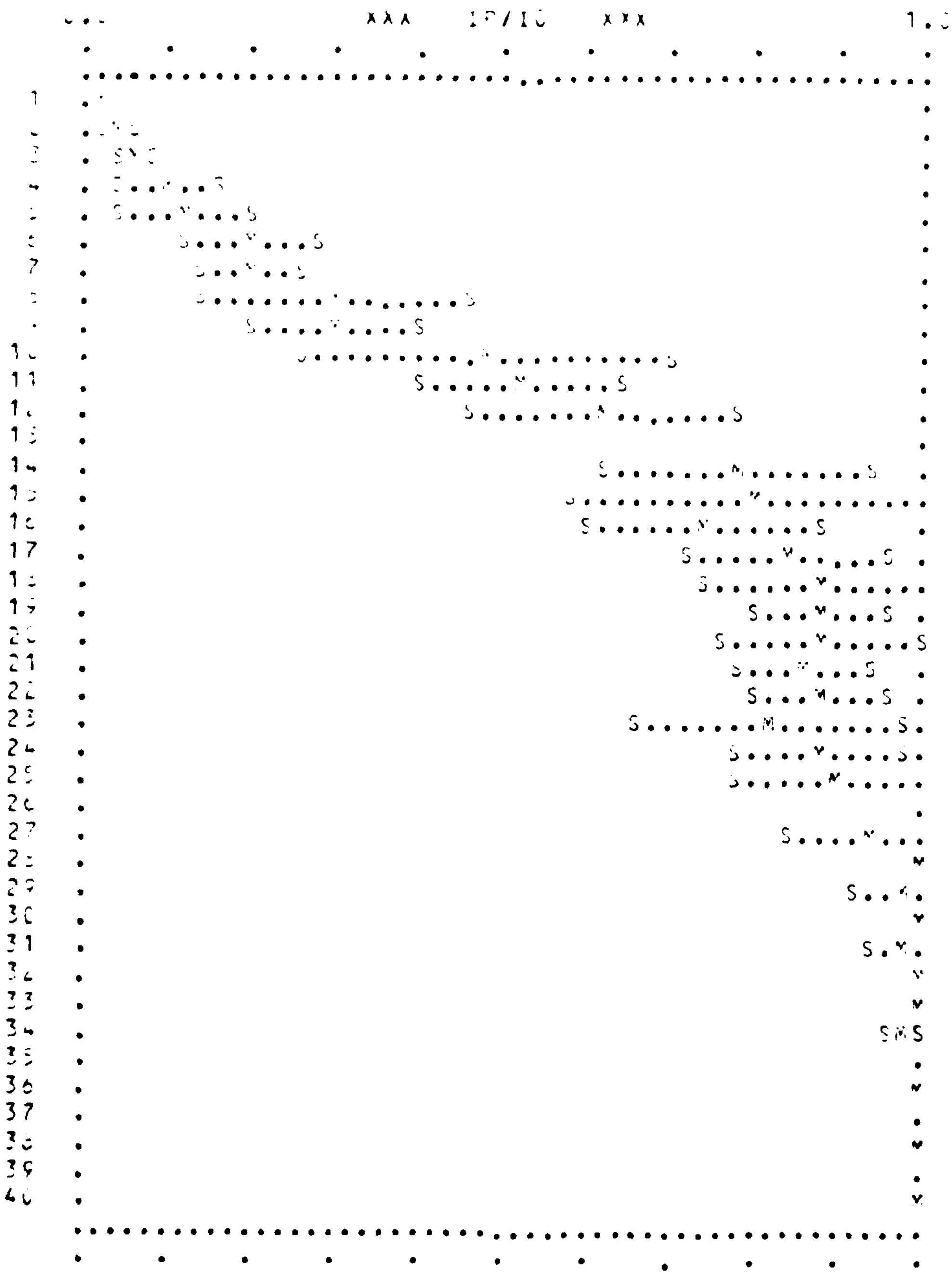


COMBINED RESULTS OF 20 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
X.FD=ALL : XMAG1= 1.41417: XNMIR=ALL

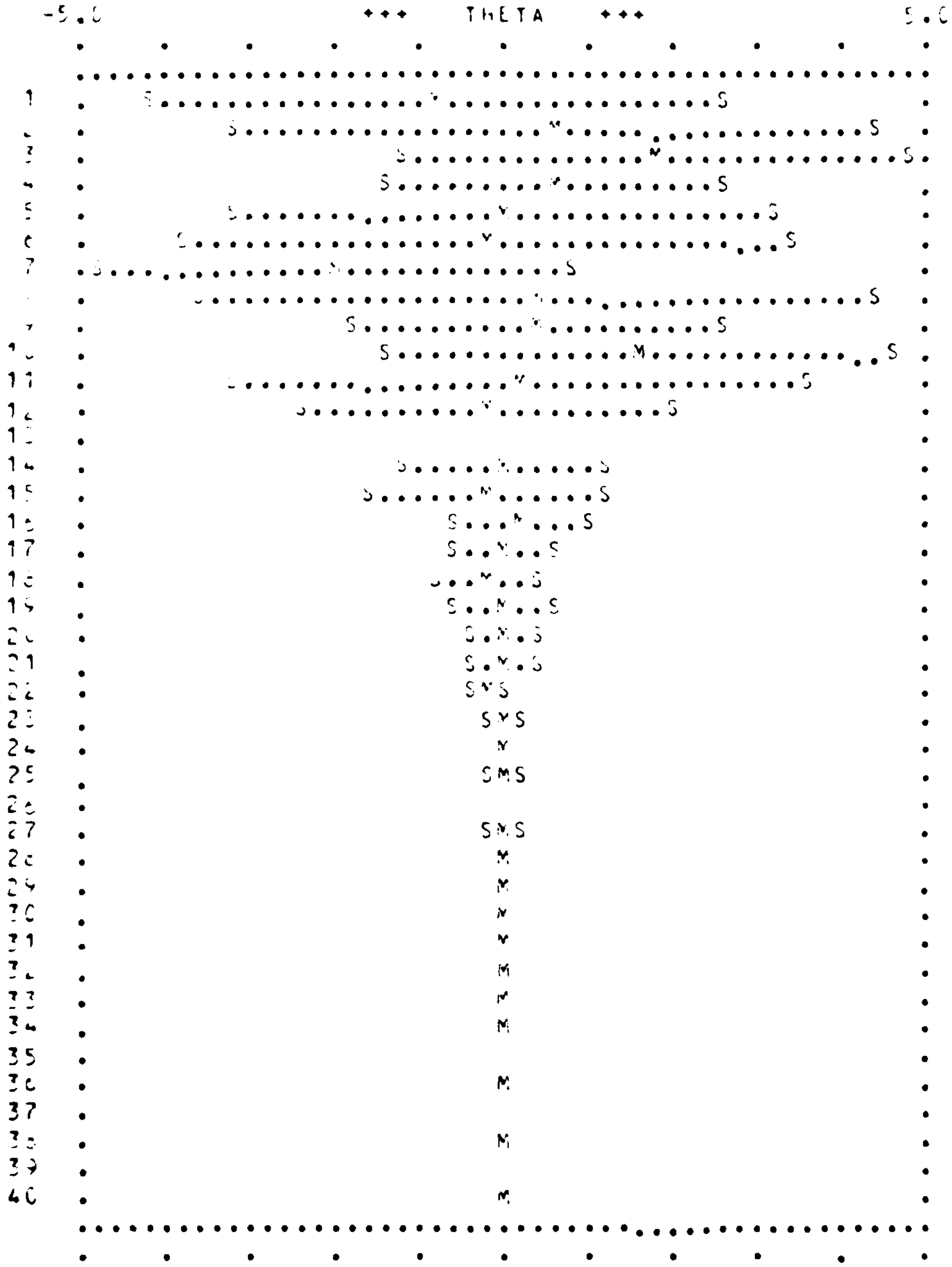



COMBINED RESULTS OF 22 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 1.41417: XNMIR=ALL

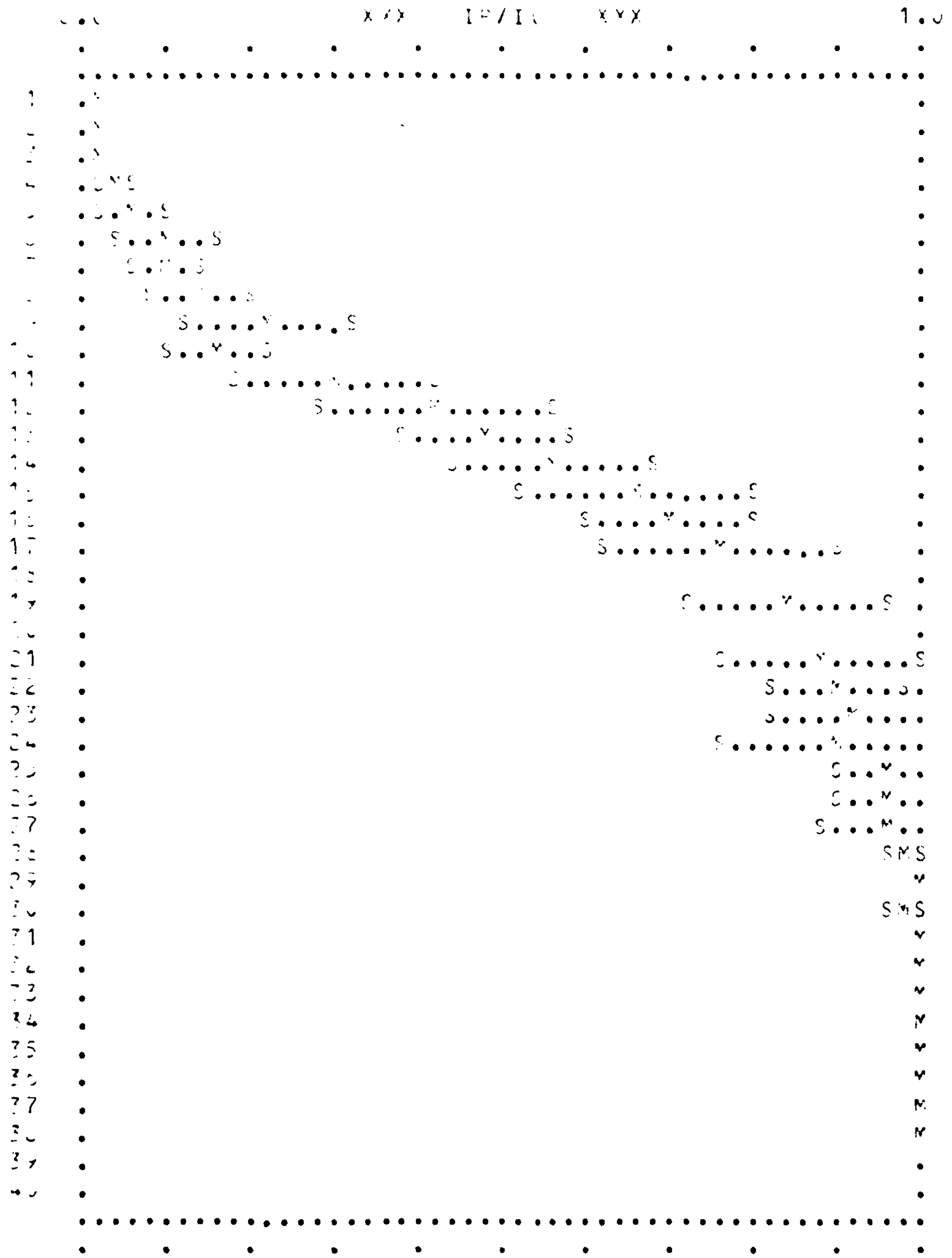


COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN
IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE
STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS
INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS).
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNF2=ALL : XMAG1= 1.58740[illegible] XNMIR=ALL

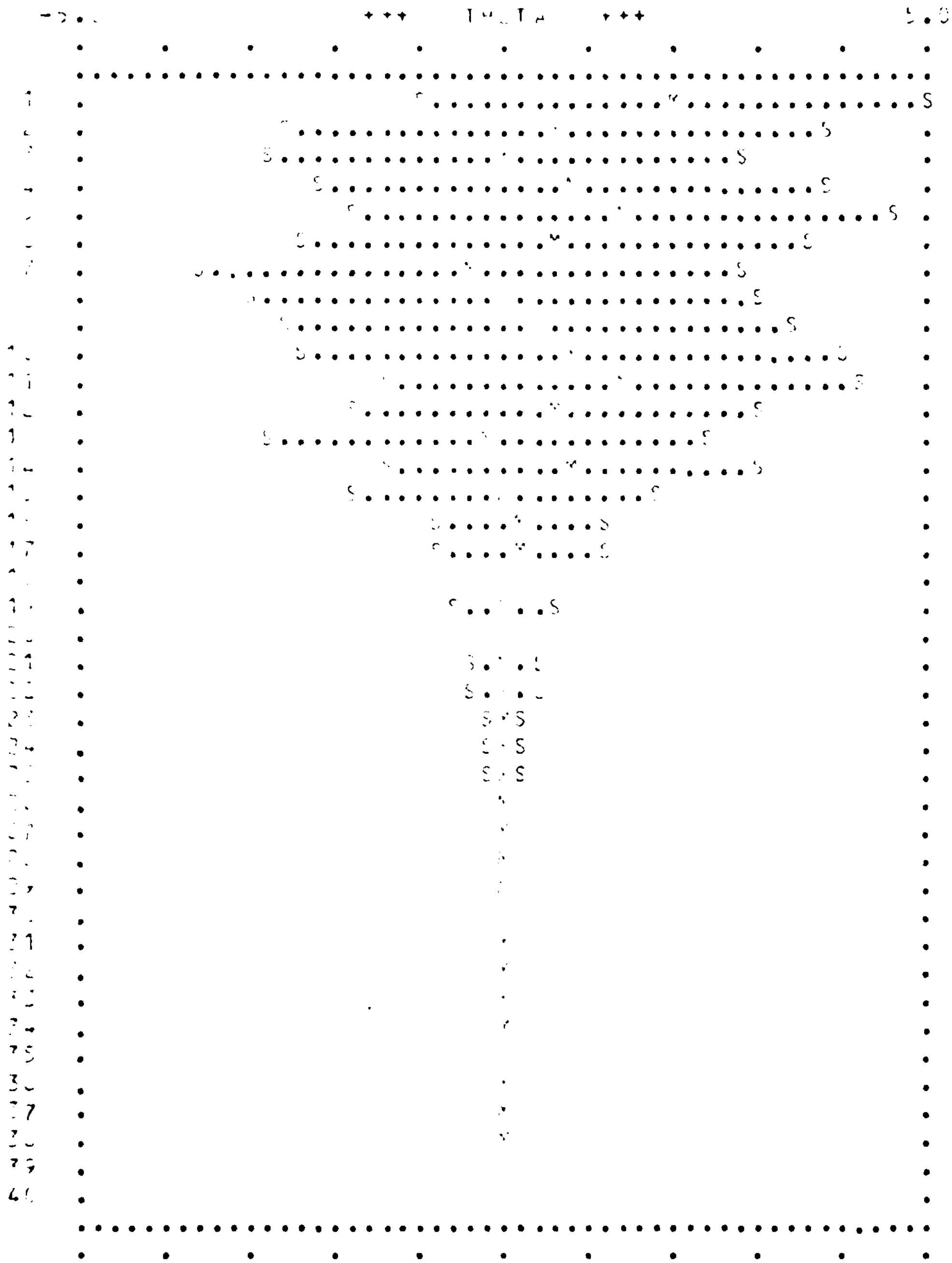



COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

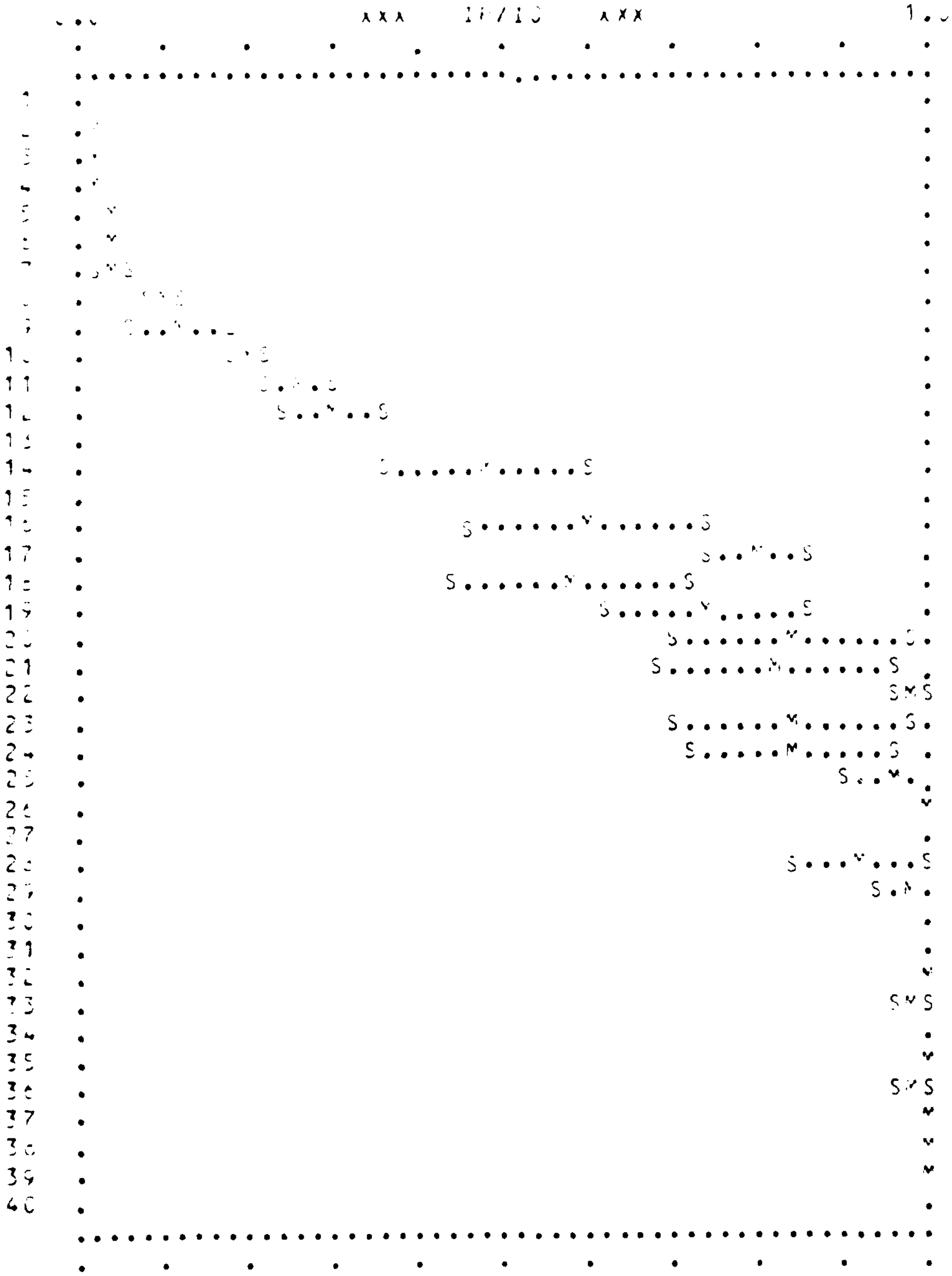
XNF2=ALL : XMAG1= 1.58740: XNMIR=ALL



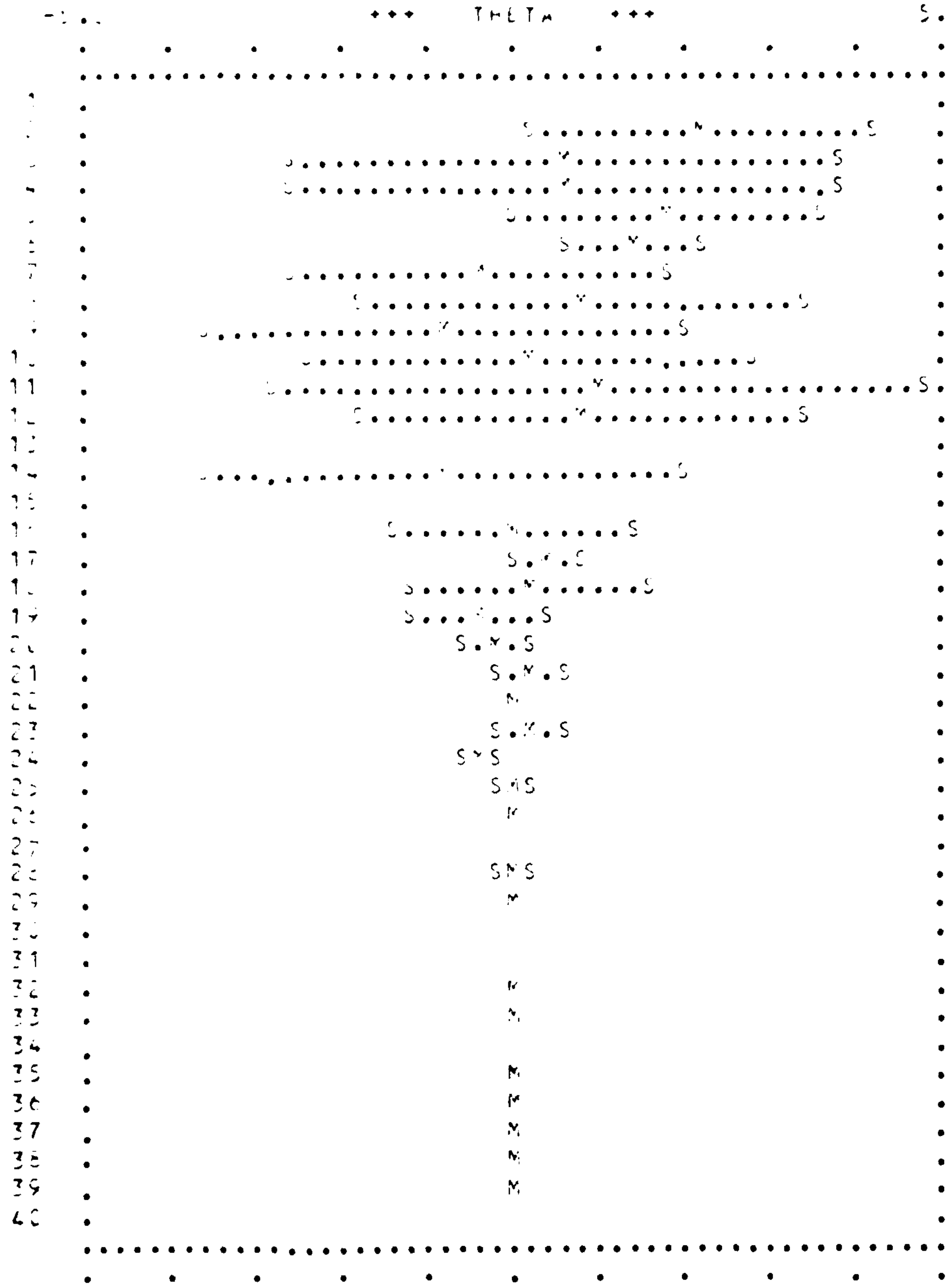

COMBINED RESULTS OF 75 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNF2=ALL : XYAC1= 2.00000: XNMIR=ALL



COMBINED RESULTS OF 75 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN
IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE
STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS
INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS).
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNF2=ALL : XMAG1= 2.00000: XNMIR=ALL

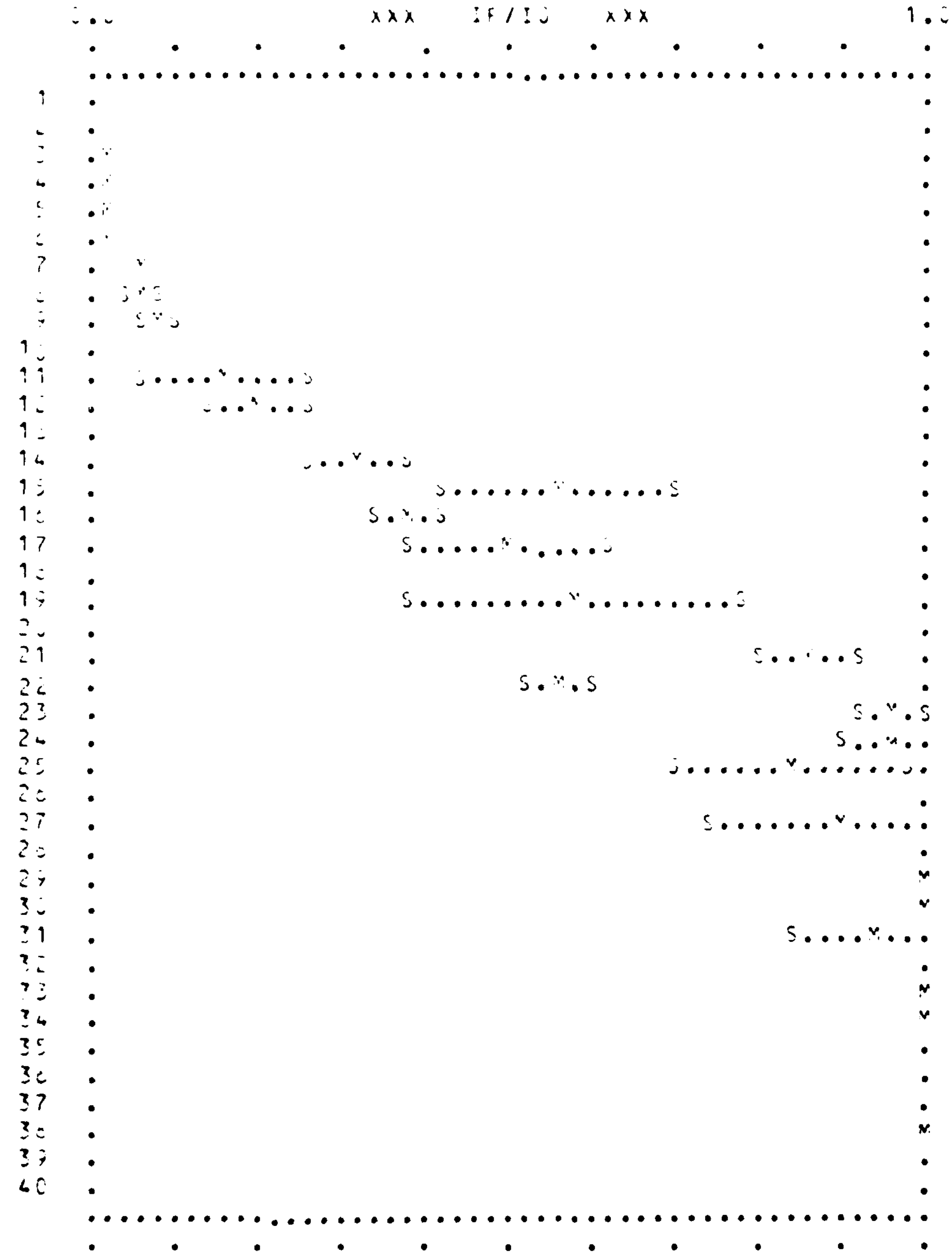


COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:
XNFD=ALL : XMAC1= 2.82840: XNMIR=ALL



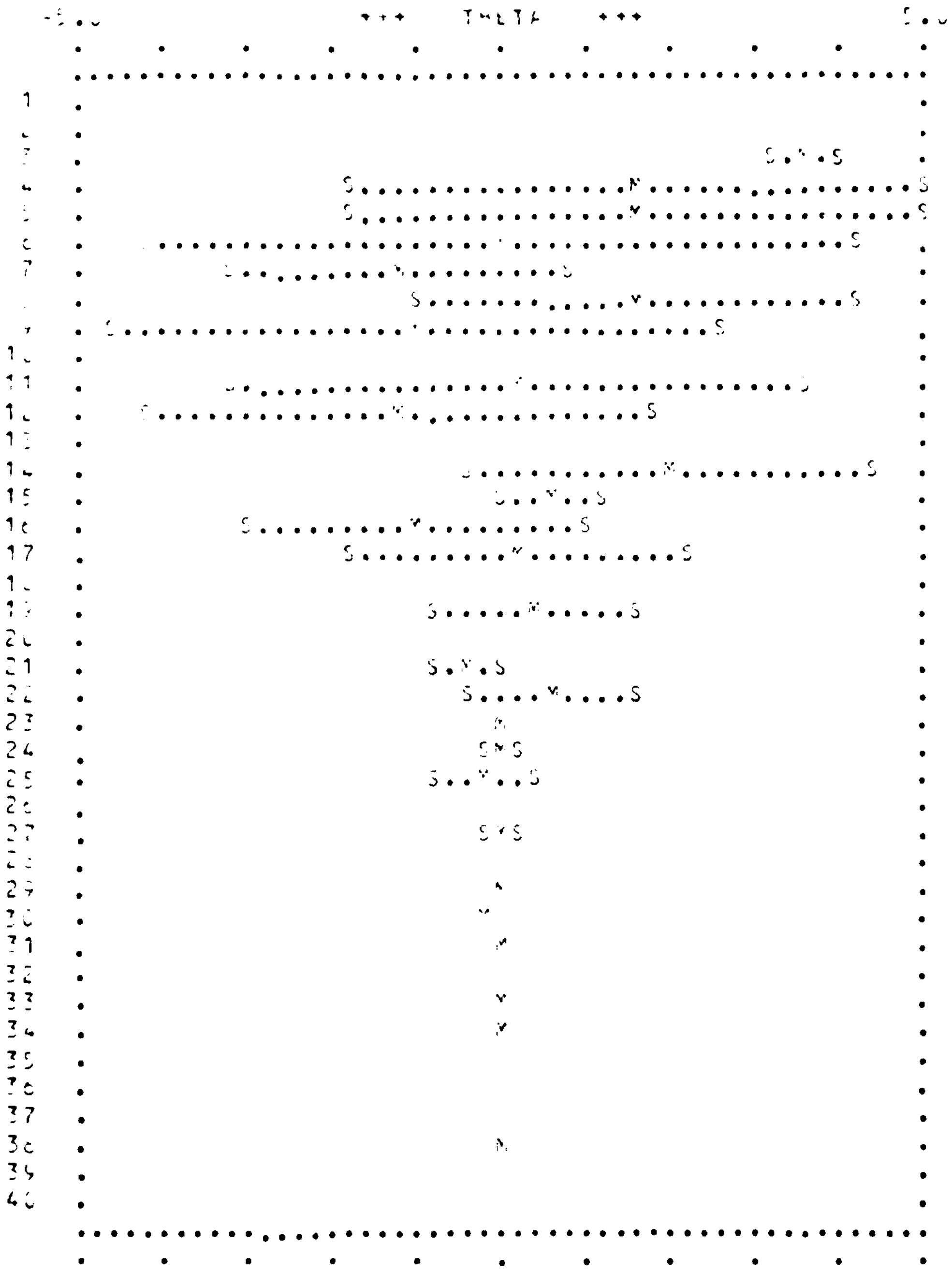

COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNFC=ALL : XMAG1= 2.82840: XNMIR=ALL



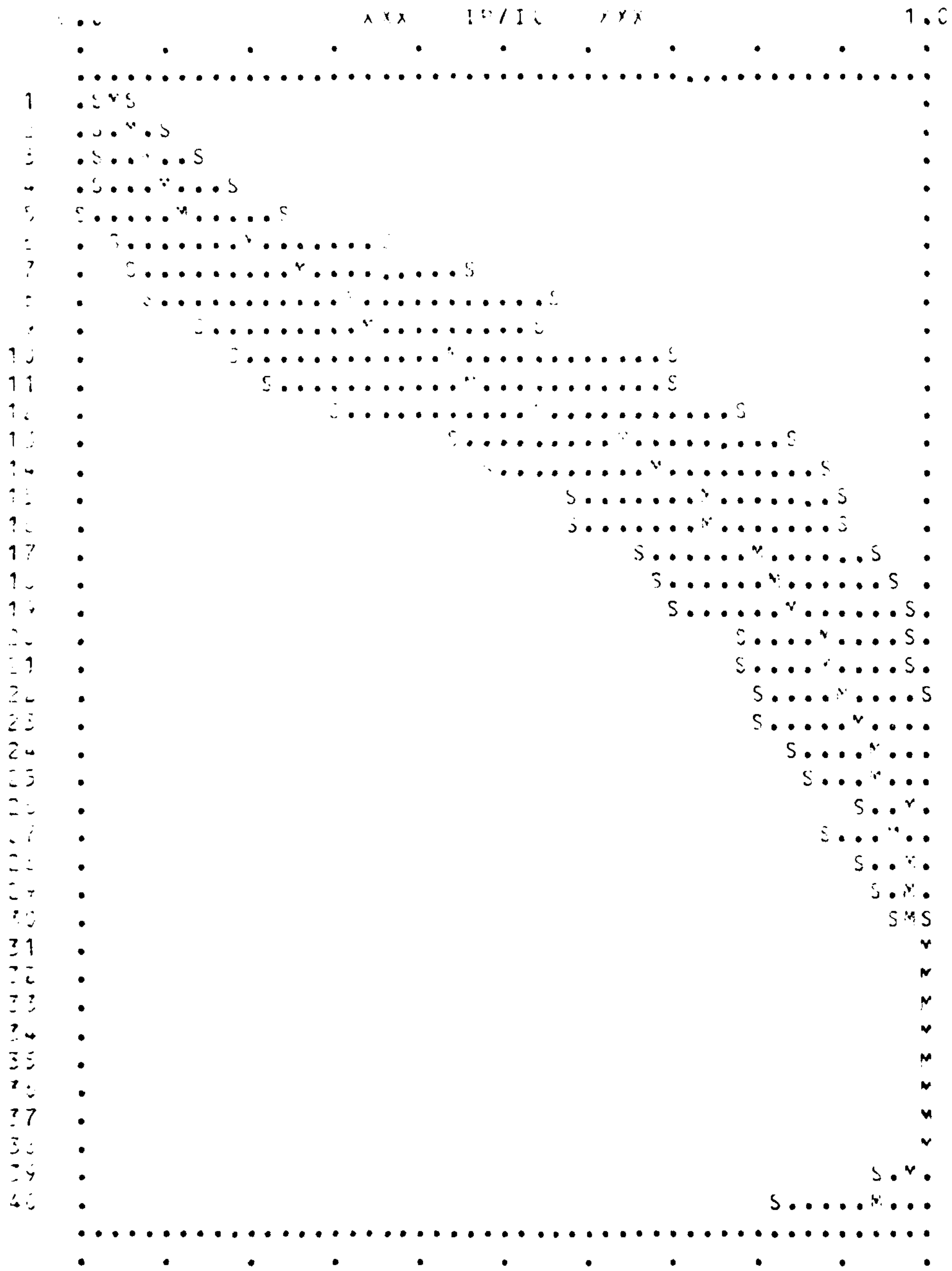

COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1= 4.00002: XNMIR=ALL

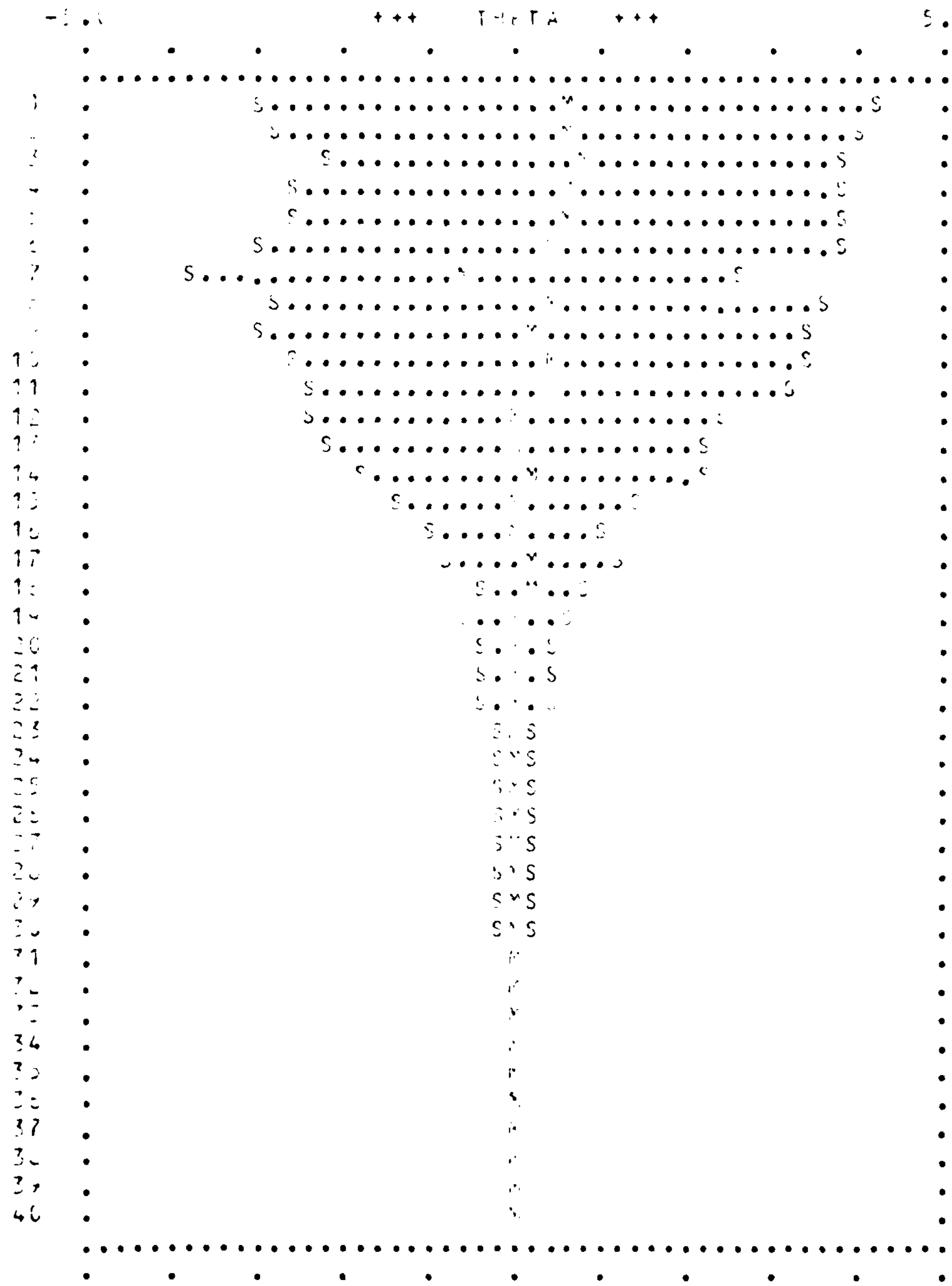



COMBINED RESULTS OF 19 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNFZ=ALL : XMAG1= 4.00002: XNMIR=ALL




COMBINED RESULTS OF 198 COMPUTER-MODELLING RUNS OF
TRANSVERSE MODE FORMATION.  THE NOMINAL MODE-FORMATION
TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS.  THE MEAN
IS INDICATED BY 'M'.  THE RANGE COVERED WITHIN ONE
STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS
INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS).
RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY
CRITERIA THAT:
XNFE=ALL : XMAGT=ALL : XNMIF=ALL




COMBINED RESULTS OF 196 COMPUTER-MODELLING RUNS OF TRANSVERSE MODE FORMATION. THE NOMINAL MODE-FORMATION TIME CORRESPONDS TO 20 UNITS ON THE X-AXIS. THE MEAN IS INDICATED BY 'M'. THE RANGE COVERED WITHIN ONE STANDARD DEVIATION ON EACH SIDE OF THE MEAN IS INDICATED BY AN 'S' ON EACH SIDE (WITH INTERVENING DOTS). RUNS SELECTED FOR PLOTTING HERE WERE DETERMINED BY CRITERIA THAT:

XNF2=ALL : XMAG1=ALL : XNMIR=ALL

## XII. CONCLUSIONS

1. The results generally agree with the geometrical formula of Anan' ev, but show statistical variations.

2. The standard deviation averaged over 198 runs at the Anan' ev time is $\pm$ 1/2 diffraction angle and average intensity of 90%.

3. The scaling dependence of mode formation with ranges of magnification (1.3 m 4) and tube Fresnel Number (76 N 8100) agrees with the Anan' ev formulation.

4. The equivalent Fresnel Number (corresponding the discrete tube Fresnel Numbers) should not be in the vicinity of an integer plus 7/8. Previous computational studies indicate that such Fresnel Numbers lead to poor transverse mode properties.

## XIII. REFERENCES


1. O. Svelto, Principles of Lasers, p. 196, Plenum Press, New York, 1976.
2. A. E. Siegman, "Unstable Optical Resonators", Appl. Opt. 13, 353-367 (1974).
3. D. B. Rensch and A. N. Chester, Appl. Opt. 12, 997 (1973).
4. R. L. Sanderson and W. Streifer, Appl. Opt. 8, 2129 (1969).
5. P. Horwitz, J. Opt. Soc. Am. 63, 1528-1543 (1973).
6. Y. A. Anan' ev, Sov. J. Quant Electron. 5, 615-617 (1975).

APPENDIX A

LISTING OF MFLPQ COMPUTER PROGRAM

```
      DOUBLE PRECISION YSEED
      DIMENSION IMXFF(50),FFMAX(50)
      DIMENSION GRAPH(51)
      DATA BLANK/1H /,DOT/1H./,X/1HX/,ZERO/1H0/,PLUS/1H+/
   75 FORMAT(' MODE-FORMATION FAR-FIELD RESULTS.')
   76 FORMAT(1H )
   77 FORMAT(1H1)
   80 FORMAT(14X,3H0.0,15X,'XXX   IP/I0   XXX',15X,3H1.0)
   81 FORMAT(13X,4H-5.0,15X,'+++   THETA   +++',15X,3H5.0)
   85 FORMAT(2I9,5F10.5)
   86 FORMAT('     ITERATION  IMXFF  FFMAX(I)')
  111 FORMAT(15X,51A1)
  112 FORMAT(10X,I3,2X,51A1)
   46 FORMAT(2I5)
C        HERE WE READ INSTEAD OF INPUTTING VIA ARGUMENT LIST
    1 READ(5,47,END=999)RUNNO
   47 FORMAT(F10.0)
      GO TO 2
      WRITE(6,77)
      WRITE(6,48)RUNNO
   48 FORMAT(1X,2F10.5)
    2 CONTINUE
      IRUNNO = RUNNO
      READ(5,49)XMITR,XNF2,XMAG1,EPSL,XNMIR,YSEED
   49 FORMAT(5(F14.5/),F14.5)
      GO TO 3
      WRITE(6,50)XMITR,XNF2,XMAG1,EPSL,XNMIR,YSEED
   50 FORMAT(1X,F5.0,3F10.5,F6.0,F14.5)
    3 CONTINUE
      ITER=XMITR
      IF(ITER .LE. 10)XISKMF=2.0
      IF(ITER .GT. 10 .AND. ITER .LE. 20)XISKMF=1.0
      IF(ITER .GT. 20)XISKMF=0.0
      ISKMF=XISKMF
      DO 60 I=1,ITER
      READ(5,53)RCOUNT,RMXFF,FFMAX(I)
   53 FORMAT(3F10.0)
      ICOUNT=RCOUNT
      IMXFF(I)=RMXFF
      GO TO 4
   51 FORMAT(1X,I3,1X,I3,1X,F10.5)
      WRITE(6,52)ICOUNT,IMXFF(I),FFMAX(I)
   52 FORMAT(1X,I3,1X,I3,5X,F10.5)
    4 CONTINUE
      IF(ICOUNT .EQ. I)GO TO 60
      WRITE(6,54)
   54 FORMAT(' ICOUNT .NE. I IN MFLPP')
      STOP 'ICOUNT'
   60 CONTINUE
      WRITE(6,77)
   61 FORMAT(1X///)
      WRITE(6,62)IRUNNO
   62 FORMAT(' RUN   ',I5)
      WRITE(6,76)
      WRITE(6,75)
```

```
      WRITE(6,86)
      WRITE(6,76)
      DO 100 I=1,ITER
      WRITE(6,85)I,IMXFF(I),FFMAX(I)
  100 CONTINUE
C          START GRAPH PLOT
      WRITE(6,77)
      WRITE(6,80)
C          NGRAPH WAS 101 IN CAV2D MFLPP
      NGRAPH = 51
      XNGRM1=NGRAPH-1
      DO 10 I=1,NGRAPH
   10 GRAPH(I)=BLANK
C          INCREMENT WAS 10 IN CAV2D
      DO 11 I=1,NGRAPH,5
   11 GRAPH(I)=DOT
      WRITE(6,111)GRAPH
      DO 15 I=1,NGRAPH
   15 GRAPH(I)=DOT
      WRITE(6,111)GRAPH
      DO 16 I=1,NGRAPH
   16 GRAPH(I)=BLANK
      DO 200 I=1,ITER
      GRAPH(1)=DOT
      GRAPH(NGRAPH)=DOT
C           NOTE MODIFICATION OF VALUE OF J COMPARED TO CAV2D
      J = (IMXFF(I) + 1)/2
      IF(J .GT. NGRAPH) J =NGRAPH
      GRAPH(J)=PLUS
      K = FFMAX(I)*XNGRM1+1.0
      IF(K .LT. 1) K = 1
      IF(K .GT. NGRAPH) K = NGRAPH
      GRAPH(K)=X
      WRITE(6,112)I,GRAPH
      GRAPH(J)=BLANK
      GRAPH(K)=BLANK
      IF(ISKMF .EQ. 0 .OR. I .EQ. ITER)GO TO 200
      DO 180 L=1,NGRAPH
  180 GRAPH(L)=BLANK
      GRAPH(1)=DOT
      GRAPH(NGRAPH)=DOT
      DO 190 IS=1,ISKMF
  190 WRITE(6,111)GRAPH
  200 CONTINUE
      DO 211 I=1,NGRAPH
  211 GRAPH(I)=DOT
      WRITE(6,111)GRAPH
      DO 212 I=.,NGRAPH
  212 GRAPH(I)=BLANK
C          INCREMENT WAS 10 IN CAV2D
      DO 213 I=1,NGRAPH,5
  213 GRAPH(I)=DOT
      WRITE(6,111)GRAPH
      WRITE(6,81)
      WRITE(6,76)
      WRITE(6,305)IRUNNO
  305 FORMAT(5X,'     RUN ',I5,'.  TRANSVERSE MODE FORMATION.',
```

```
   1'  RELATIVE VALUES OF')
    WRITE(6,306)
306 FORMAT(                    9X,' CENTRAL FAR-FIELD INTENSITY',
   1' IP/IC, ARE INDICATED BY X.')
    WRITE(6,307)
307 FORMAT(                              9X,' THE ANGLE THETA',
   1' MEASURES THE DEVIATION (IN UNITS OF A')
    WRITE(6,308)
308 FORMAT(                                          9X,' DIFFRACTION',
   1' ANGLE, I.E. APERTURE WIDTH/WAVELENGTH) OF THE POINT')
    WRITE(6,309)
309 FORMAT(                                                        9X,
   1' OF MAXIMUM FAR-FIELD INTENSITY FROM STRAIGHT-AHEAD',
   2' DIRECTION.')
    WRITE(6,320)XNF2,XMAG1
320 FORMAT(9X,' TUBE FRESNEL NUMBER=',F11.5,
   1        ';MAGNIFICATION=',F7.5)
    WRITE(6,322)EPSL,XNMIR
322 FORMAT(9X,' ALIGNMENT EPSL=',F8.5,
   1        ';NO OF MESH POINTS ON MIRROR=',F5.0)
324 FORMAT(5X,' RANDOM NUMBER SEED=',F14.5)
    GO TO 1
999 WRITE(6,77)
    STOP 'EOF'
    END
```

APPENDIX B

LISTING OF MFRSCH PLOT COMPUTER PROGRAM

```
      LOGICAL SRCHRN
C
C     MNEMONIC FOR 'SEARCH FOR RUN NUMBER'.  IF TRUE, WE ARE
C     ONLY INTERESTED IN LOCATING A PARTICULAR RUN OR RUNS BY
C     NUMBER.  IF FALSE, WE ARE ONLY INTERESTED IN LOCATING
C     ALL RUNS HAVING CERTAIL VALUES (TEST VALUES) OF ONE OR
C     MORE OF THE VARIABLES XNF2,XMAG1,EPSL,XNMIR, AND YSEED.
C
      LOGICAL L1A,L2A,L3A,L4A,L5A
C
C     TRUTH VALUES OF L1A,L2A,L3A,L4A, AND L5A ARE DETERMINED
C     BY WHETHER WE ARE INTERESTED IN THE VALUE OF XNF2,XMAG1,
C     EPSL,XNMIR, AND YSEED, RESPECTIVELY. FOR EACH RUN.  IF
C     WE ARE INTERESTED (FOR PURPOSES OF COMPARISON WITH THE
C     TEST VALUE) IN THE VALUE OF ONE (OR MORE) OF THESE
C     VARIABLES, THE TRUTH VALUE OF THE CORRESPONDING LOGICAL
C     VARIABLE WILL BE FALSE; OTHERWISE IT WILL BE TRUE.
C
      LOGICAL L1,L2,L3,L4,L5
C
C     TRUTH VALUES OF L1,L2,L3,L4,L5 INDICATE WHETHER A GIVEN
C     RUN SATISFIES THE CRITERIA FOR XNF2,XMAG1,EPSL,XNMIR,
C     AND YSEED, RESPECTIVELY.  IF WE ARE NOT INTERESTED IN
C     THE VALUE OF A PARTICULAR VARIABLE OR WE ARE AND ITS
C     VALUE FOR A PARTICULAR RUN MATCHES THE TEST VALUE, THE
C     TRUTH VALUE OF THE CORRESPONDING LOGICAL VARIABLE FOR
C     THAT RUN IS TRUE; OTHERWISE FALSE.
C
      INTEGER TOTNOM
C
C     MNEMONIC FOR TOTAL NUMBER OF MATCHES WHEN WE ARE
C     COMPARING AGAINST ONE OR MORE TEST VALUES.
C
      INTEGER TOTNOC
C
C     MNEMONIC FOR TOTAL NUMBER OF CASES; THAT IS, THE HIGHEST SEQUENCE
C     NUMBER THAT WILL BE ASSIGNED BY THE VARIABLE NOCASE (SEE
C     EXPLANATION OF NOCASE LATER IN THIS PROGRAM, JUST AFTER IT IS
C     ENCOUNTERED FOR THE FIRST TIME.
C
      DIMENSION TRUNNO(200)
C
C     MNEMONIC FOR TEST RUN NUMBER WHEN WE ARE ONLY INTERESTED
C     IN LOCATING RUNS BY NUMBER.  DIMENSIONING TO N ALLOWS
C     FOR UP TO N-1 VALID TEST RUN NUMBERS (I.E., POSITIVE
C     INTEGERS) + A NONPOSITIVE SENTINEL.
C
      DIMENSION RUNNO(200),XMITR(200),XNF2(200),XMAG1(200),EPSL(200),
     1          XNMIR(200),YSEED(200),RMXFF(200,50),FFMAX(200,50)
C
C     THE FIRST SUBSCRIPT OF ALL VARIABLES IN THE PRECEDING
C     DIMENSION STMT. IS THE MAXIMUM NO. OF RUNS ALLOWED.
C     THE SECOND SUBSCRIPT OF RMXFF AND FFMAX IS THE MAXIMUM
C     NO. OF ITERATIONS ALLOWED FOR ANY GIVEN RUN.
C
```

```
      DIMENSION MATCH(200)
C
C     THE ELEMENTS OF THE ARRAY MATCH ARE THE SEQUENCE NOS.
C     OF THE RUNS THAT MEET THE CRITERIA WE ARE INTERESTED IN.
C
    2 FORMAT(1H1)
C              3-25-81.  BEGINNING WITH SELECTED SEQUENCE NUMBERS
C           BASED ON SPECIFIED VALUES OF PARAMETERS, PREPARE
C           TABLES AND SUMMARIES FOR PLOTTING, ETC.
C             THE CUMULATIVE NUMBER OF CALCULATED POINTS WHICH
C           CORRESPOND TO A SPECIFIED VALUE OF IX AND IY WILL
C           BE OBTAINED BY FIRST INITIALIZING TO ZERO THE
C           ELEMENTS OF ARRAYS IDISTI((I,J) AND IDISTA(I,J),
C           THEN IN A LARGE LOOP OVER ALL VALUES OF MATCHES
C           WHICH HAVE BEEN FOUND, ADDING UNITY TO SUITABLE
C           ENTRIES IN THESE TWO TABLES OF DISITRIBUTIONS.
C             IDISTI(I,J) IS DISTRIBUTION OF INTENSITY VALUES
C           (I.E. VALUES OF I/IO).
C             IDISTA(I,J) IS DISTRIBUTION OF ANGLE VALUES
C           (I.E. VALUES OF THETA/THETAO).
      DIMENSION IDISTI(40,50),IDISTA(40,50)
      DIMENSION GRAPH(51)
      DIMENSION SYMBL(27)
C          3-25-81
C          WE ASSUME WE HAVE AVAILABLE TXNF2,TXMAG1 AND TXNMIR
C          EXCEPT FOR DIMENSIONS, FORMATS, ETC. THIS GETS
C          INSERTED JUST AFTER COMPLETION OF PLOT IN THE
C          MFRSCHPLOT PROGRAM.
      DIMENSION TXNF2C(2)
      DIMENSION TMAG1C(2)
      DIMENSION TNMIRC(2)
      DIMENSION PPTC(2)
      DIMENSION RMEANI(40),SDI(40),RMEANA(40),SDA(40)
      DATA PRTC/'ALL ','     '/
      DATA MINNOR/2/
C      LUNO=2
C      NTOTNM=4
C      XNXVAL=40.0
C      PARM=2.0
C    1 WRITE(3,1000)
C 1000 FORMAT(' INPUT TXNF2,TXMAG1,TXNMIR BY 3F10.5'/)
C      READ(3.1010)TXNF2,TXMAG1,TXNMIR
C 1010 FORMAT(3F10.5)
C      WRITE(3,1010)TXNF2,TXMAG1,TXNMIR
      DATA SYMBL/1H ,1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ,
     11HK,1HL,1HM,1HN,1HO,1HP,1HQ,1HR,1HS,1HT,1HU,1HV,1HW,
     21HX.1HY.1HZ/
      DATA BLANK/1H /,DOT/1H./,X/1HX/,ZERO/1H0/,PLUS/1H+/
      F(X,Y) = ALOG(X)/ALOG(Y)
C           NOTE THAT LUNI MUST BE SET TO 5 AND LUNO SET TO
C           6 FOR MAINFRAME CALCS
      LUNI=5
      LUNO=6
C       NOTE THAT VALUES OF NXVAL AND NYVAL MUST CORRESPOND
C     TO FIRST AND SECOND DIMENSIONS OF IDISTI(I,J) AND
C     IDISTA(I,J).
      NXVAL=40
```

```
      NYVAL=50
      XNXVAL=NXVAL
      XNYVAL=NYVAL
      MAXNOR=200
C
C     MNEMONIC FOR THE MAXIMUM NUMBER OF RUNS ALLOWED.
C
      MAXNOT=200
C
C     MNEMONIC FOR THE MAXIMUM NO. OF TEST RUN NUMBERS ALLOWED.
C
      MAXNOM=200
C
C     MNEMONIC FOR MAXIMUM NO. OF MATCHES ALLOWED.
C
      MAXNOI=50
C
C     MNEMONIC FOR MAXIMUM NO. OF ITERATIONS ALLOWED FOR ANY
C     GIVEN RUN.
C
      NOCASE=0
C
C     MNEMONIC FOR THE SEQUENCE (CASE) NUMBER OF THE CURRENT
C     RUN (1,2,3,ETC.).
C
   90 NOCASE=NOCASE+1
      IF(NOCASE .GT. MAXNOR)STOP 'MAXNOR'
      READ(5,100)RUNNO(NOCASE)
  100 FORMAT(F10.0)
      IF(RUNNO(NOCASE) .LE. -1.0)GO TO 160
      READ(5,110)XMITR(NOCASE),XNFZ(NOCASE),XMAG1(NOCASE),
     *             EPSL(NOCASE),XNMIR(NOCASE),YSEED(NOCASE)
  110 FORMAT(2(F14.5/),F14.3)
      ITER=XMITR(NOCASE)
      IF(ITER .GT. MAXNOI)STOP 'MAXNOI'
      DO 130 I=1,ITER
      READ(5,220)RCOUNT,RMAFF(NOCASE,I),FFMAX(NOCASE,I)
  220 FORMAT(3F10.0)
  130 CONTINUE
      GO TO 90
160   TOTNOC=NOCASE-1
      READ(5,10)SRCHRN
   10 FORMAT(L4)
170   NOMTCH=1
C
C     MNEMONIC FOR THE NUMBER OF MATCHES THAT HAVE CURRENTLY
C     BEEN FOUND WHEN WE ARE COMPARING AGAINST ONE OR MORE
C     TEST VALUES.
C
      IF(SRCHRN)GO TO 30
C
C     IF WE REACH THIS POINT WE ARE INTERESTED IN COMPARING
C     AGAINST ONE OR MORE TEST VALUES RATHER THAN LOCATING
C     RUNS BY NUMBER.
C
      READ(5,20,END=99999)TXNFZ,TXMAG1,TEPSL,TXNMIR,TYSEED,STATSC,
     1      STABLE,SPLOTS
```

```
C
C       MNEMONIC FOR TEST VALUES OF THE VARIABLES XNF2,XMAC1,
C       EPSL,XNMIR, AND YSEED.  THE READ-IN VALUE OF ANY ONE
C       OF THESE VARIABLAS IS .LE. -1.0 ONLY IF WE ARE NOT
C       INTERESTED IN COMPARING ITS VALUE AGAINST THE ACTUAL
C       VALUES OF THE CORRESPONDING VARIABLE (HAVING THE SAME
C       NAME AS THE TEST VARIABLE EXCEPT FOR THE LEADING 'T'
C       BEING OMITTED).
C
   20  FORMAT(-F10.0)
       WRITE(6,2)
       WRITE(6,21)
21     FORMAT(1H+,'TEST VALUES FOR THIS TEST ARE AS FOLLOWS-'/
       WRITE(6,25)TXNF2,TXMAC1,TEPSL,TXNMIR,TYSEED
25     FORMAT(1H0,5F15.5)
       L1A=TXNF2  .LE. -1.0
       L2A=TXMAC1 .LE. -1.0
       L3A=TEPSL  .LE. -1.0
       L4A=TXNMIR .LE. -1.0
       L5A=TYSEED .LE. -1.0
       GO TO 15
   30  WRITE(6,2)
C
C       IF WE REACH THIS POINT WE ARE ONLY INTERESTED IN LOCATING
C       RUNS BY NUMBER.
C
       DO 40 I=1,MAXNOT
       READ(5,20,END=99+99)TRUNNO(I)
       IF(TRUNNO(I) .GT. 0.0 .AND. I .LE. MAXNOT)STOP 'MAXNOT'
       IF(TRUNNO(I) .GT. 0.0)GO TO 40
C
C       WHEN WE REACH THIS POINT THE SENTINEL HAS JUST BEEN
C       READ IN.
C
       NORUNS=I-1
C
C       NORUNS IS THE TOTAL NUMBER OF TEST RUN NUMBERS.  ITS
C       VALUE MUST BE DETERMINED BY A COUNTER (I) SINCE WE DO
C       NOT IN GENERAL KNOW WHAT IT IS.
C
C       WE ARE NOW THROUGH READING TEST RUN NUMBERS; HENCE WE NOW
C       JUMP OUT OF THE LOOP.
C
       GO TO 50
   40  CONTINUE
50     WRITE(6,60)
60     FORMAT(1H+,'TEST RUN NUMBERS FOR THIS TEST ARE AS FOLLOWS-'/)
       READ(5,20)STATSC,STABLE,SPLOTS
       DO 180 I=1,NORUNS
       WRITE(6,70)TRUNNO(I)
70     FORMAT(1X,F10.1)
180    CONTINUE
       DO 145 NOCASE=1,TOTNOC
       DO 140 I=1,NORUNS
       IF(ABS(TRUNNO(I)-RUNNO(NOCASE)) .GT. 0.001)GO TO 140
C
C       IF WE REACH THIS POINT THERE IS A MATCH BETWEEN THE CURRENT
```

```
C       RUN NO. AND ONE OF THE TEST RUN NOS.
C
        MATCH(NOMTCH)=NOCASE
        NOMTCH=NOMTCH+1
        IF(NOMTCH .GT. MAXNOM)STOP 'MAXNOM'
        GO TO 145
  140   CONTINUE
145     CONTINUE
        GO TO 991
150     DO 990 NOCASE=1,TOTNOC
        L1=L1A .OR. (ABS(TXNF2 -XNF2 (NOCASE)) .LT. 0.001)
        L2=L2A .OR. (ABS(TXMAG1-XMAG1(NOCASE)) .LT. 0.001)
        L3=L3A .OR. (ABS(TEPSL -EPSL (NOCASE)) .LT. 0.001)
        L4=L4A .OR. (ABS(TXNMIR-XNMIR(NOCASE)) .LT. 0.001)
        L5=L5A .OR. (ABS(TYSEED-YSEED(NOCASE)) .LT. 0.001)
        IF(.NOT.(L1 .AND. L2 .AND. L3 .AND. L4 .AND. L5))GO TO 990
C
C       IF WE REACH THIS POINT A RUN HAS BEEN REACHED WITH THE
C       PROPERTY THAT ALL VARIABLES WE ARE INTERESTED IN HAVE
C       VALUES AGREEING WITH THE CORRESPONDING TEST VALUES.
C       THUS A 'MATCH' HAS BEEN FOUND.
C
        MATCH(NOMTCH)=NOCASE
        NOMTCH=NOMTCH+1
        IF(NOMTCH .GT. MAXNOM)STOP 'MAXNOM'
990     CONTINUE
991     TOTNOM=NOMTCH-1
        IF(TOTNOM .EQ. 0)WRITE(6,995)
995     FORMAT(1X,'NO MATCHES FOR THIS SET OF TEST DATA.')
        IF(TOTNOM .EQ. 0)GO TO 170
        WRITE(6,1000)TOTNOM
 1000   FORMAT(1H0,'THE TOTAL NO. OF MATCHES = ',I3)
        WRITE(6,1010)
1010    FORMAT(10X,'MATCH NO.',5X,'SEQUENCE NO.',5X,
      1                 'RUN NO.'/)
        DO 1100 I=1,TOTNOM
        J=MATCH(I)
        IRUNNO=RUNNO(J)
        WRITE(6,1050)I,J,IRUNNO
1050    FORMAT(16X,I3,14X,I3,9X,I3)
 1100   CONTINUE
        IF(SRCHRN)GO TO 9999
        WRITE(6,1150)
1150    FORMAT(/' DATA FOR MATCHES (FOR PURPOSES OF',
      1          ' VERIFICATION):')
        WRITE(6,1200)
 1200   FORMAT(1H0,5X,'RUN NO.',5X,'XNF2',5X,'XMAG1',5X,'EPSL',
      1              5X,'XNMIR',5X,'YSEED'/)
        DO 1300 I=1,TOTNOM
        J=MATCH(I)
        WRITE(6,1250)RUNNO(J),XNF2(J),XMAG1(J),EPSL(J),XNMIR(J),
      1               YSEED(J)
1250    FORMAT(6X,F7.0,2X,F7.1,3X,F7.5,2X,F7.2,3X,F7.1,
      1              3X,F7.5)
 1300   CONTINUE
9999    PARM=2.0
C           THE VALUE OF PARM IS USED IN DETERMINING THE VALUE
```

```
C          OF THE INDEX IX FOR STORING INFORMATION ABOUT A
C          PARTICULAR ITERATION.  THE VALUE OF IX IS THE RATIO
C          OF THE ITERATION NUMBER TO THE NOMINAL ESTIMATE OF
C          THE NUMBER OF ITERATIONS WHICH WILL BE REQUIRED FOR
C          COMPLETION OF MODE FORMATION MULTIPLIED BY THE
C          FRACTION 1.0/PRAR OF THE TOTAL NUMBER OF X VALUES
      PARM=2.0
      DO 410 IX=1,NXVAL
      DO 410 IY=1,NYVAL
      IDISTI(IX,IY) = 0
      IDISTA(IX,IY) = 0
  410 CONTINUE
      DO 430 NUMTCH=1,TOTNUM
      J = MATCH(NUMTCH)
C          FOR DIAGNOSTICS ONLY
C     WRITE(LUNO,411)J
  411 FORMAT(' AT 410+5, J = ',I4)
      XNMRT = F(XNF2(J),XMAG1(J))
C     WRITE(LUNO.412)XNMRT
  412 FORMAT(' XNMRT = ',E12.5)
      NITR = X*ITR(J)
C          GET YMAX FOR NORMALIZATION OF PLOT
      YMAX = 0.0
      DO 414 ITER = 1.NITR
      IF(FFMAX(J,ITER) .GT. YMAX) YMAX = FFMAX(J,ITER)
  414 CONTINUE
C*********LINE BELOW IS TMPORARY MODIFICATION 9-8-81
      YMAX=1.0
C     WRITE(LUNO.415)YMAX
  415 FORMAT(' YMAX = ',E12.5)
      DO 420 ITER = 1,NITR
      XITER = ITER
      IX=ITER
      IF(IX .LT. 1) IX = 1
      IF(IX .GT. NXVAL) GO TO 420
      IYI = XNYVAL*FFMAX(J,ITER)/YMAX + 1.0
      IF(IYI .LT. 1) IYI = 1
      IF(IYI .GT. NYVAL) IYI = NYVAL
      IDISTI(IX,IYI) = IDISTI(IX,IYI) + 1
      IYA = RMXFF(J,ITER)        /2.0
      IF(IYA .LT. 1) IYA = 1
      IF(IYA .GT. NYVAL) IYA = NYVAL
      IDISTA(IX,IYA) = IDISTA(IX,IYA) + 1
  420 CONTINUE
  430 CONTINUE
C       BEGINNING HERE WE WISH TO MAKE FIRST A PLOT OF THE
C     ARRAY IDISTI(I,J) AND LATER OF THE ARRAY IDISTA(I,J).
C     IN EACH CASE FOLLOW THE GENERAL PATTERN OF THE MFLPP
C     LINE-PRINTER PLOT PROGRAM EXCEPT THAT WE WILL PLOT
C     ONLY INFORMATION ON EITHER INTENSITY OR ANGLE, BUT
C     NOT BOTH, IN A PARTICULAR GRAPH.  INSTEAD OF PUTTING
C     ONLY ONE NON-BLANK CHARACTER INTO A PLOT ARRAY
C     REGARDING INTENSITY, ONE WILL USUALLY PUT SEVERAL.
C       WITHIN A LOOP TO PLOT ON EACH LINE, FIRST PUT BLANKS IN
C     ALL COLUMNS ,I.E. ALL ELEMENTS OF "GRAPH".  THEN WITHIN
C     A LOOP ON IY(OR J) PUT SUITABLE CHARACTER(A) INTO
C     GRAPH(J) WHENEVER THE VALUE OF IDISTI(IX.IY) IS 1
```

```
C       (B FOR 2, ETC).  EACH LINE THEN WILL CONTAIN SOME
C       BLANKS, SOME A'S, SOME B'S ETC IN GENERAL.  OF COURSE
C       FOR LIMITED AMOUNT OF DATA THERE MAY BE A LOT OF BLANKS
C       AND PERHAPS NO CHARCTERS BEYOND A OR B.
C         AFTER COMPLETING A PLOT ON INTENSITY, ONE WILL THEN DO
C       A VERY SIMILAR PLOT REGARDING ANGLE.
C         WE  NEED TO SET UP AN ARRAY OF CHARACTERS A, B, C,
C       ETC BY A DATA STATEMENT RE SYMBOL OR SOME SUCH.  THIS
C       IS SIMILAR TO WHAT WE HAVE DONE ELSEWHERE FOR MAKING
C       "CONTOUR" PLOTS, EXCEPT THAT NOW THE CHARACTERS REPRESENT
C       NOT VALUES OF A PARTICULAR VARIABLE FROM DIRECT
C       CALCULATIONS BUT OF THE CUMULATIVE NUMBER OF CASES WHICH
C       PRODUCED A RESULT WITH A PARTICULAR VALUE.
   76 FORMAT(1H )
   77 FORMAT(1H1)
 80     FORMAT(1H+,8X,3H0.0,15X,'XXX   IP/IC   XXX',15X,3H1.0)
 81     FORMAT(1H+,7X,4H-5.0,15X,'+++   THETA   +++',15X,3H5.0)
   85 FORMAT(2I9,5F10.5)
  111 FORMAT(10X,51A1)
  112 FORMAT(5X,I3,2X,51A1)
C            START GRAPH PLOT
C            USE INDEX IPI1A2 TO INDICATE WHETHER CURRENTLY
C            PLOTTING INTENSITY OR ANGLE
      IPI1A2=1
  120 WRITE(LUNO,77)
      IF(IPI1A2 .GT. 1)GO TO 8
      WRITE(LUNO,80)
      GO TO 9
    8 WRITE(LUNO,81)
    9 NGRAPH = 51
C         NOTE THAT NGRAPH SHOULD BE SAME AS NYVAL
      XNGPM1=NGRAPH-1
      DO 12 I=1,NGRAPH
   12 GRAPH(I)=BLANK
      DO 11 I=1,NGRAPH,5
   11 GRAPH(I)=DOT
      WRITE(LUNO,111)GRAPH
      DO 15 I=1,NGRAPH
   15 GRAPH(I)=DOT
      WRITE(LUNO,111)GRAPH
      DO 16 I=1,NGRAPH
   16 GRAPH(I)=BLANK
      DO 200 IX=1,NXVAL
      GRAPH(1)=DOT
      GRAPH(NGRAPH)=DOT
C          KMATCH MUST NOT EXCEED DIMENSION OF SYMBL(K)LESS 2
      KMAX=25
      DO 190 IY=2,NGRAPH
      IF(IPI1A2 .GT. 1)GO TO 168
      K = IDISTI(IX,IY-1) + 1
      GO TO 169
  168 K = IDISTA(IX,IY-1)+1
  169 IF(K .GT.KMAX) K = KMAX+2
      GRAPH(IY) = SYMBL (K)
  190 CONTINUE
C          IF RIGHTMOST POINT WOULD BE BLANK, SET IT TO A DOT
      IF(GRAPH(NGRAPH) .EQ. BLANK)GRAPH(NGRAPH)=DOT
```

```
      WRITE(LUNO.112)IX,GRAPH
  200 CONTINUE
      DO 211 I=1,NGRAPH
  211 GRAPH(I)=DOT
      WRITE(LUNO,111)GRAPH
      DO 212 I=1,NGRAPH
  212 GRAPH(I)=BLANK
      DO 213 I=1,NGRAPH,5
  213 GRAPH(I)=DOT
      WRITE(LUNO,111)GRAPH
      NTOTNM=TOTNOM
      INRMT=XMXVAL/PARM
      IF(TXNF2 .LE. -1.0)GO TO 344
      ENCODE(357,TXNF20)TXNF2
  357 FORMAT(F8.1)
      GO TO 346
  344 DO 345 I=1,2
  345 TXNF20(I) = PRTC(I)
  346 CONTINUE
      IF(TXMAG1 .LE. -1.0)GO TO 354
      ENCODE(347,TMAG1C)TXMAG1
  347 FORMAT(F8.5)
      GO TO 356
  354 DO 355 I=1,2
  355 TMAG1C(I) = PRTC(I)
  356 CONTINUE
      IF(TXNMIR .LE. -1.0)GO TO 364
      ENCODE(367,TNMIRC)TXNMIR
  367 FORMAT(F8.0)
      GO TO 366
  364 DO 365 I=1,2
  365 TNMIRC(I) = PRTC(I)
  366 CONTINUE
  370 FORMAT(9X,'COMBINED RESULTS OF',I4,' COMPUTER-',
     1'MODELLING RUNS OF'/9X,'TRANSVERSE MODE FORMATION.',
     2'  THE NOMINAL MODE-FORMATION'/9X,'TIME CORRESPONDS TO'.
     3I4,' UNITS ON THE X-AXIS. APPEARANCE'/9X,'OF ',
     4'CHARACTERS BEYOND ''A'' IN ALPHABET INDICATES THAT'/9X,
     5'MORE THAN ONE RUN PRODUCED A RESULT AT THAT POINT.')
  375 FORMAT(9X,'RUNS SELECTED FOR PLOTTING HERE WERE',
     1' DETERMINED BY')
  380 FORMAT(9X,'XNF2='.2A4,':    XMAG1='.2A4,':    XNMIR='2A4)
      WRITE(LUNO,76)
      WRITE(LUNO,76)
      WRITE(LUNO,370)NTOTNM,INRMT
      WRITE(LUNO,375)
      IF(SRCHRN)WRITE(6.376)
376   FORMAT(9X,'SPECIFIED RUN NOS.')
      IF(SRCHRN)GO TO 378
      WRITE(6,377)
377   FORMAT(9X,'CRITERIA THAT:')
      WRITE(LUNO.380)TXNF2C.TMAG1C.TNMIRC
C      GO TO 1
378   IPI1A2 = IPI1A2 + 1
      IF(IPI1A2 .LT. 3)GO TO 120
385   IF(STATSC .NE. 0.0)GO TO 170
      CALL MEANSD(IDISTI,NXVAL,NYVAL,RMEANI,SDI,MINNOR)
```

```
      CALL MEANSD(IDISTA,NXVAL,NYVAL,RMEANA,SDA,MINNOR)
      IF(STABLE .NE. 0.0)GO TO 425
      WRITE(6,2)
      WRITE(6,390)TXNF2,TXMAG1,TXNMIR
390   FORMAT(1H+,9X,'XNF2=',F15.5,5X,'XMAG1=',F15.5,5X,'XNMIR=',F15.5)
      WRITE(6,395)
395   FORMAT(1H0,9X,'I',4X,'MEAN--IP/10',5X,'STANDARD DEVIATION--IP/10',
     1      4X,'MEAN--THETA',5X,'STANDARD DEVIATION--THETA'/)
      DO 405 I=1,NXVAL
      WRITE(6,400)I,RMEANI(I),SDI(I),RMEANA(I),SDA(I)
400   FORMAT(1X,I10,F15.5,15X,F15.5,F15.5,15X,F15.5)
405   CONTINUE
425   IF(SPLOTS .NE. 0.0)GO TO 170
      IPI1A2=1
 2120 WRITE(LUNO,77)
      IF(IPI1A2 .GT. 1)GO TO 2008
      WRITE(LUNO,80)
      GO TO 2009
 2008 WRITE(LUNO,81)
 2009 NGRAPH = 51
      NGRLS1=NGRAPH-1
C       NOTE THAT NGRAPH SHOULD BE SAME AS NYVAL
      XNGRM1=NGRAPH-1
      DO 2012 I=1,NGRAPH
 2012 GRAPH(I)=BLANK
      DO 2011 I=1,NGRAPH,5
 2011 GRAPH(I)=DOT
      WRITE(LUNO,111)GRAPH
      DO 2015 I=1,NGRAPH
 2015 GRAPH(I)=DOT
      WRITE(LUNO,111)GRAPH
      DO 2200 IX=1,NXVAL
      GRAPH(1)=DOT
      GRAPH(NGRAPH)=DOT
      DO 2100 IY=2,NGRLS1
      GRAPH(IY)=BLANK
2100  CONTINUE
      IF(IPI1A2 .GT. 1)GO TO 2110
      RMEAN=RMEANI(IX)
      SD=SDI(IX)
      GO TO 2130
2110  RMEAN=RMEANA(IX)
      SD=SDA(IX)
2130  IF(RMEAN .EQ. -1.0)GO TO 2180
      RMEAN=RMEAN+0.49
      SD=SD+0.49
      MEAN=RMEAN
      ISD=SD
      IF(MEAN .EQ. 1 .OR. MEAN .EQ. NGRLS1)ISD=0
      MLSDP1=MEAN-ISD+1
      IF(MLSDP1 .LT. 1)GO TO 2135
      GRAPH(MLSDP1)=1HS
2135  MPSDP1=MEAN+ISD+1
      IF(MPSDP1 .GT. NGRAPH)GO TO 2140
      GRAPH(MPSDP1)=1HS
2140  IF(ISD .LT. 2)GO TO 2160
      INIT=MLSDP1+1
```

```
      IF(INIT .LT. 1)INIT=1
      IFINAL=MPSDF1-1
      IF(IFINAL .GT. NGRAPH)IFINAL=NGRAPH
      DO 2150 I=INIT,IFINAL
      GRAPH(I)=DOT
2150  CONTINUE
2160  GRAPH(MEAN+1)=1HM
2180  WRITE(6,112)IX,GRAPH
2200  CONTINUE
      DO 2211 I=1,NGRAPH
 2211 GRAPH(I)=DOT
      WRITE(LUNO,111)GRAPH
      DO 2212 I=1,NGRAPH
 2212 GRAPH(I)=BLANK
      DO 2213 I=1,NGRAPH,5
 2213 GRAPH(I)=DOT
      WRITE(LUNO.111)GRAPH
      NTOTNM=TOTNOM
      INRMT=XNXVAL/PARM
      IF(TXNF2 .LE. -1.0)GO TO 2344
      ENCODE(2357,TXNF2C)TXNF2
 2357 FORMAT(F6.1)
      GO TO 2346
 2344 DO 2345 I=1,2
 2345 TXNF2C(I) = PRTC(I)
 2346 CONTINUE
      IF(TXMAG1 .LE. -1.0)GO TO 2354
      ENCODE(2347,TMAG1C)TXMAG1
 2347 FORMAT(F5.3)
      GO TO 2356
2354  DO 2355 I=1,2
 2355 TMAG1C(I) = PRTC(I)
 2356 CONTINUE
      IF(TXNMIR .LE. -1.0)GO TO 2364
      ENCODE(2367.TNMIRC)TXNMIR
 2367 FORMAT(F6.0)
      GO TO 2366
 2364 DO 2365 I=1,2
 2365 TNMIRC(I) = PRTC(I)
 2366 CONTINUE
      WRITE(LUNO,76)
      WRITE(LUNO,76)
      WRITE(6,2370)NTOTNM,INRMT
 2370 FORMAT(9X,'COMBINED RESULTS OF',I4,' COMPUTER-',
     1'MODELLING RUNS OF'/9X,'TRANSVERSE MODE FORMATION.',
     2'  THE NOMINAL MODE-FORMATION'/9X,'TIME CORRESPONDS TO'.
     3I4,' UNITS ON THE X-AXIS.  THE MEAN'/9X,'IS INDICATED BY ''M''.  '
     4,'THE RANGE COVERED WITHIN ONE'/9X,'STANDARD DEVIATION ON EACH ',
     5'SIDE OF THE MEAN IS'/9X,'INDICATED BY AN ''S'' ON EACH SIDE ',
     6'(WITH INTERVENING DOTS).')
      WRITE(LUNO,375)
      IF(SRCHRN)WRITE(6,376)
      IF(SRCHRN)GO TO 2379
      WRITE(6,377)
      WRITE(LUNO,380)TXNF2C,TMAG1C,TNMIRC
C      GO TO 1
 2376 IPI1A2 = IPI1A2 + 1
```

```
      IF(IPI1A2 .LT. 3)GO TO 2120
      GO TO 170
99999 WRITE(6,2)
      STOP 'EOF'
      END
```

```
      SUBROUTINE MEANSD(IARRAY,IX,IY,RMEAN,SD,MINNOR)
      DIMENSION IARRAY(IX,IY),RMEAN(IX),SD(IX)
      LOGICAL LOGICL
      DO 200 I=1,IX
      SUM=0.0
      SUMSQ=0.0
      ICOUNT=0
      DO 100 J=1,IY
      ICOUNT=ICOUNT+IARRAY( I, J)
      RJ=J
      ARRAY=IARRAY(I,J)
      SUM=SUM+ARRAY*RJ
      SUMSQ=SUMSQ+ARRAY*RJ**2
100   CONTINUE
      LOGICL=ICOUNT .LT. MINNOR
      IF(LOGICL)RMEAN(I)=-1.0
      IF(LOGICL)SD(I)=-1.0
      IF(LOGICL)GO TO 200
      COUNT=ICOUNT
      RMEAN(I)=SUM/COUNT
      VARNCE=SUMSQ/COUNT-RMEAN(I)**2
      IF(ABS(VARNCE) .LT. 1.0E-3)VARNCE=0.0
      SD(I)=SQRT(VARNCE)
200   CONTINUE
      RETURN
      END
```

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